AIR CONDITIONING HEATING AND VENTILATING

DECEMBER, 1955 – 52nd YEAR

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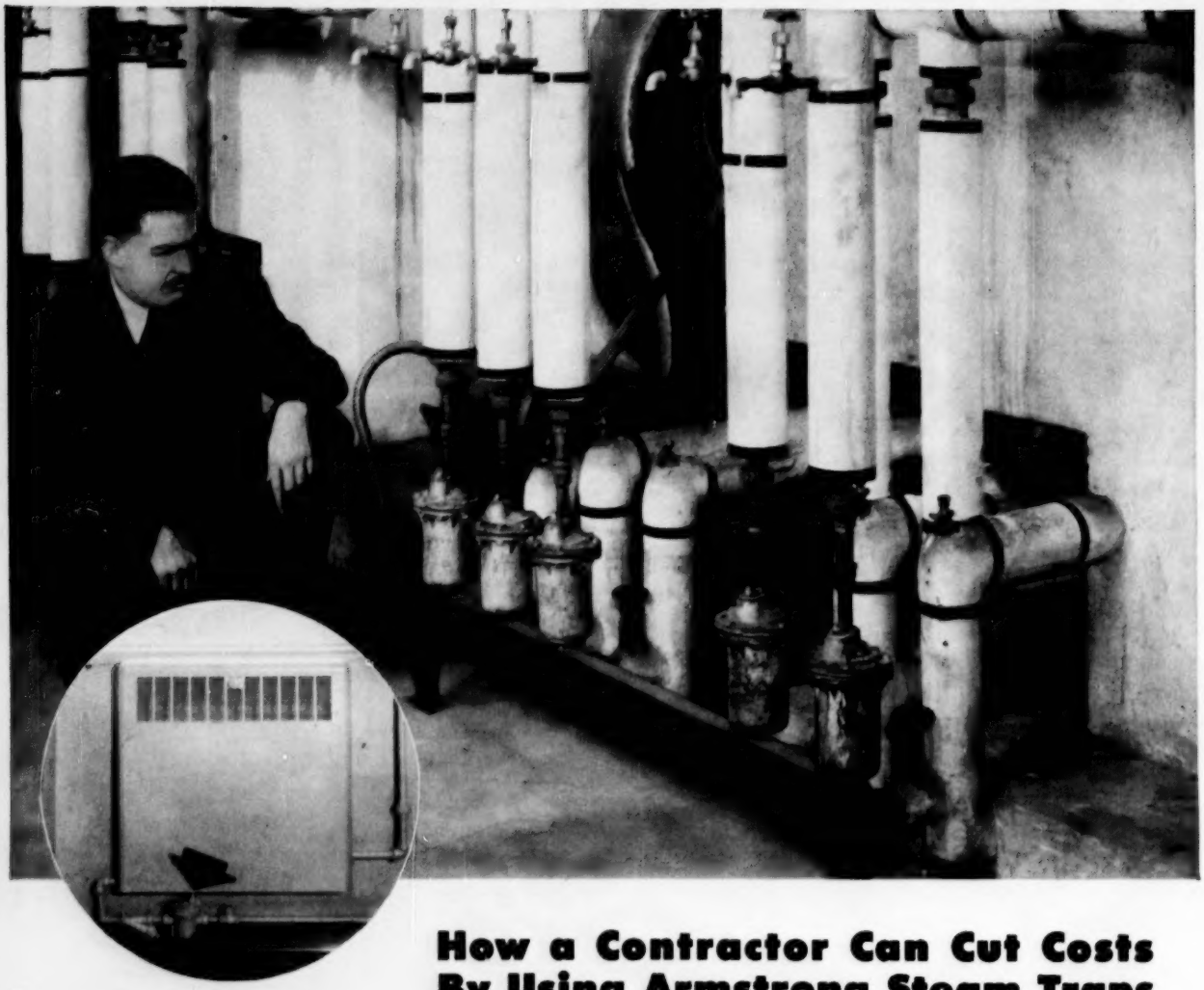


How a Contractor Can Cut Costs By Using Armstrong Steam Traps

● There is more than meets the eye in steam traps. If you don't regularly specify Armstrongs, you ought to know about these cost factors:

1. First Cost. The size and, hence, price of a trap is determined by its capacity. The high capacity of each Armstrong trap often enables you to select a size smaller than you would otherwise use.

2. Installation Cost.

Connections. Armstrong offers you a choice of straight-through horizontal or vertical connections, as well as a right angle trap, to save fittings and labor.

Strainers—seldom needed because ordinary dirt and scale won't plug up an Armstrong. When strainers are desirable, Armstrong offers built-in strainer traps that cost less to buy and install than separate traps and strainers.

Check Valves. Here again, Armstrong offers a cost saving with a stainless steel, spring loaded internal check valve that is superior to external check valves.

3. Call-Back Cost. When you put in Armstrong traps, the job is done. The traps will work without attention, not just for a month or two or even a year, but *more commonly 3 or 4 or 5 years!* No traps have so enviable a record for low maintenance as Armstrongs because the mechanisms in low pressure traps are identical in design, workmanship and materials to those used in traps for 900 lbs. pressure, 900°F temperature.

Get the figures and the facts. Call your local factory-trained Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
846 MAPLE ST., THREE RIVERS, MICHIGAN

How to Select and Install Steam Traps for Lowest Cost:

Here are two pieces of useful literature you should have—free on request:

1. Armstrong Steam Trap Book—44 pages of trap data, tables, hookup diagrams and selection information.

2. Unit Heater Trapping—trap selection and installation plus BTU output tables for every model of 30 makes of unit heaters.

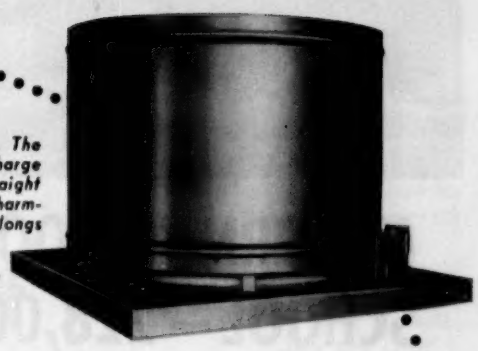
UNCONDITIONALLY GUARANTEED TO SATISFY THE USER

APPLICATION ENGINEERED

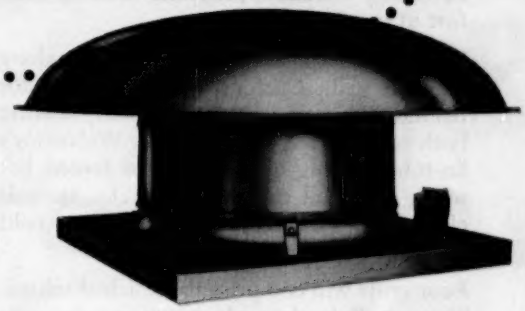
ARMSTRONG
STEAM TRAPS

For whisper-quiet operation *on schools, hospitals. The all-new Centrifugal Roof Ventilator runs at low speeds, moves large volumes of air efficiently against static pressures.*

For oil or grease laden air. *The newly redesigned Vertical Discharge Roof Ventilator exhausts air straight up at high velocity. It keeps harmful residue off the roof . . . prolongs roof life.*



3 new LOW-SILHOUETTE ROOF VENTILATORS



The Power-Flow Roof Ventilator is a ruggedly built unit in an aerodynamically correct, weatherproof housing. Most popular of all for general useage.

Low in silhouette . . . distinctively profiled . . . these units blend well with modern architecture. What's more, they deliver all the air you pay for. All performance ratings are the output of the *completely assembled* unit . . . obtained from wind tunnel tests as per Standard Test Code for Power Roof Ventilators . . . conform to U. S. Department of Commerce Standard 178-51. Capacities up to 40,900 CFM. Send for catalogs today.

3 New catalogs

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DeBOTHEZAT FANS, Dept. HV-1255
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Please send catalogs on your following roof ventilators . . .

- ☐ *Centrifugal,* for quiet operation
- ☐ *Vertical Discharge,* for oil or grease laden air
- ☐ *Power-Flow,* for normal industrial air
- ☐ All three ventilators

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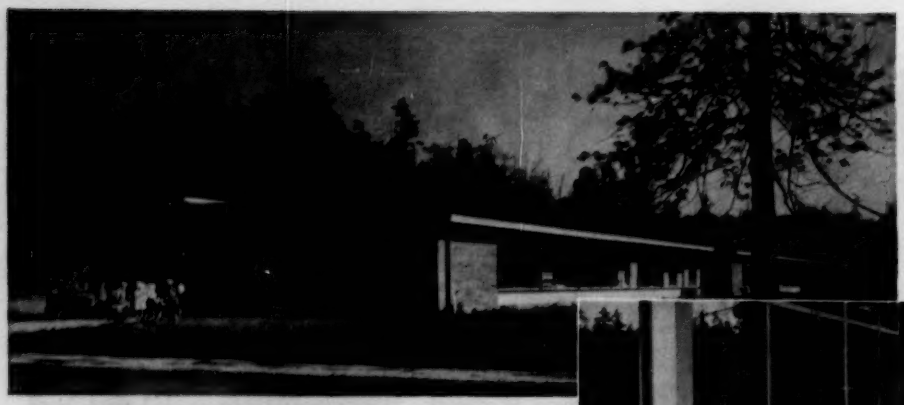
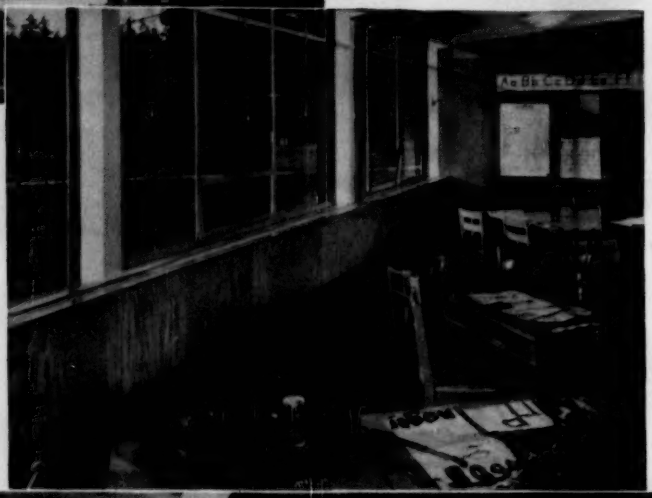


Normandy Park Elementary School, of the Highline School District, near Seattle, Washington, now accommodates 300 pupils, has an ultimate capacity of 500. Architects: Waldron & Dietz. Mechanical Engineers: Stern & Towne. Heating Contractors: University Plumbing & Heating Company.

Photographs by Dearborn-Massar



Classroom with Custom Webster Walvector behind plywood panels.

MODERN 10-ROOM SCHOOL—$228,000

Waldron & Dietz, Seattle architects, designed new Normandy Park Elementary School. Tru-Perimeter Forced Hot Water Heating with Webster Walvector was economically installed, provided heating comfort at low fuel cost.

Note Standard Webster Walvector along corridor wall; Custom Webster Walvector behind plywood in the classroom, heating both recirculated and fresh air. Walvector's fin-tube heating element carries forced hot water along all exposed walls . . . spreads clean, gentle, even warmth . . . no cold spots, hot spots or drafts.

Four units will comprise the finished school. There will be two classroom wings, only one of which has already been built. Units are separated to avoid need for fire walls and fire doors, but are connected by open passages. Exterior and interior finishes are inexpensive, and skylights are simplified. Construction costs were held to $10.88 per sq. ft., or $760 per pupil.

Investigate the heating design economies of Tru-Perimeter Webster Walvector for *your* school. See your Webster Representative or write us.

Address Dept. HV-12

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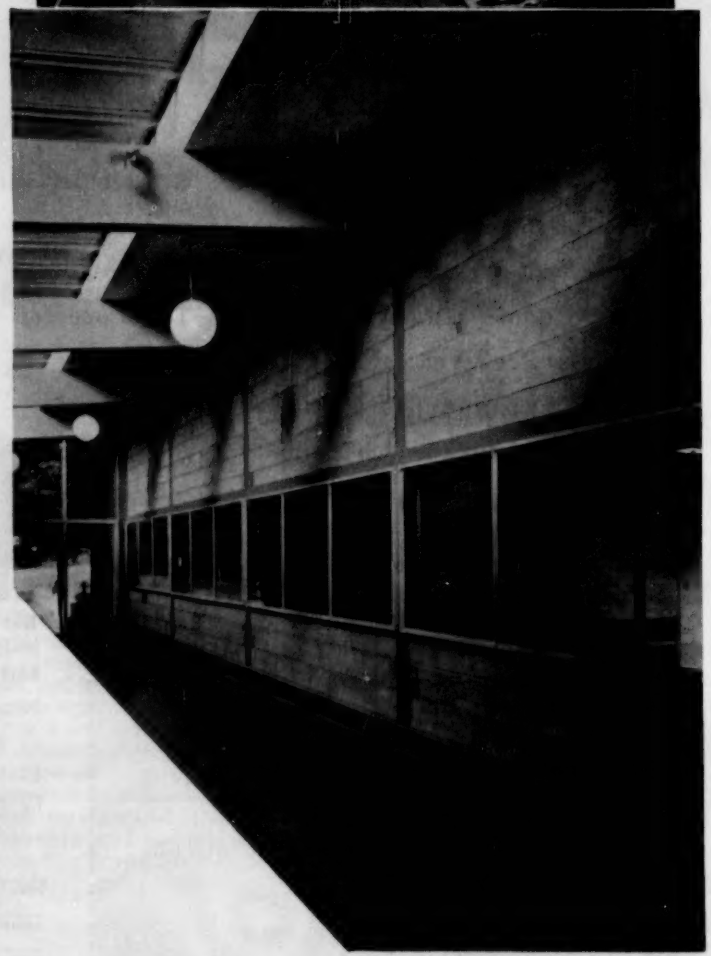
For Steam or Hot Water Heating

AND **Webster also makes Baseboard and Convector Radiation; heating and process steam specialties; Moderator Controls for Steam heating and controls for hot water heating; and Unit Heaters. Data on request.**



Corridor beside gymnasium. Webster Walvector keeps corridor warm, even when gym is unheated and unused.

AIR CONDITIONING HEATING AND VENTILATING

DECEMBER, 1955

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The Cover: Mrs. Adnan Tarcici of Bierut, Lebanon demonstrates collapsible solar cooker developed by her husband and displayed at Solar Engineering Exhibit held in conjunction with a World Symposium on Applied Solar Energy in Phoenix, Arizona. See page 73.

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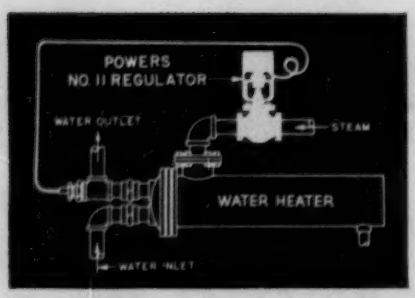
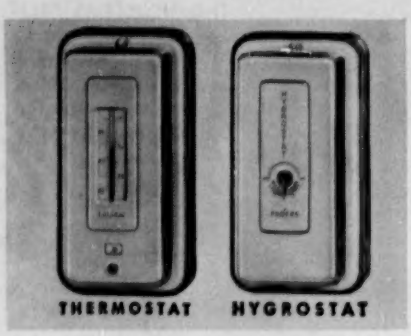
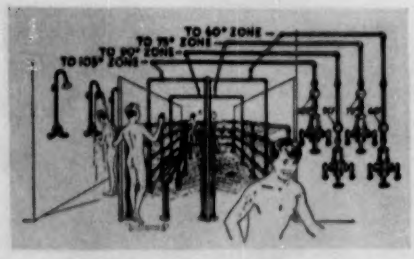


Comfortable Water Temperature in Swimming Pools is obtained with Powers thermostatic Regulators for water heaters. *Fuel Economy* also results from eliminating OVER-heated water.



Comfortable Air Temperature in Pool Area and Locker Room is assured with Powers control of temperature, humidity and proper ventilation.

Greater Comfort and SAFER Showers with Powers double protection against scalding. Temperature remains constant wherever the bather wants it regardless of *pressure* or *temperature* changes in water supply lines.



Zone Showers with straddle rail, often used in connection with swimming pools require the dependable temperature control supplied by the four Powers thermostatic controllers above. (e-46)

in Swimming Pools, Locker Rooms and Showers

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In the world's largest indoor swimming pool at Great Lakes Naval Training Station and in thousands of other famous pools from coast to coast, Powers control provides water and atmospheric comfort.

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Only a few of our many controls are shown here. Others are available for whirlpool arm and leg baths and many other types of hydrotherapy.

Consult Powers on Thermostatic Control for swimming pools, locker rooms and showers. An experienced engineer in Powers nearest office will gladly help you select the right type of control for your requirements.

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Over 60 years of Automatic Temperature and Humidity Control

HIGH SPOTS

• **Radiant cooling and heating** will be subject for research at ASHAE lab with Burgess Manning participating.

• Business next year will be even **better than this year,** with greater output, higher wages, and higher prices in prospect, according to forecasts of 201 leading economists polled in annual Dodge survey.

• The Bureau of Mines has a new **Division of Anthracite** to direct the government's part in a $17 million state and federal **mine drainage program** in Pennsylvania's anthracite region.

• A New York research chemist, Tibor S. Laszlo, director of Fordham University's **high temperature research** laboratory, has been awarded a grant of $14,000 from the National Science Foundation to finance construction of a 120-inch **solar furnace** to generate temperatures approaching **9,000 deg F.** Mr. Laszlo has been generating up to 5,400 deg F with a 60-inch Army surplus searchlight reflector.

• **Test methods for air cleaning** devices will be subject of an ASHAE research program at the University of Minnesota under Professor A. B. Algren and research associate K. T. Whitby with financial support from 14 industrial concerns.

• Forecast for 1955 sales of hot water and steam heating equipment, based on sales through October, was for **30% increase in home heating boilers** and 40% increase in baseboard type radiators.

• The Institute of Gas Technology has announced a laboratory **method for producing methane** (chief component of natural gas) by pressure hydrogasification. If pilot plant tests succeed, a peak load carrier for natural gas systems may be developed.

• A new 3,000-home subdivision by Vorhof-Duenke in St. Louis will feature 2-ton **central air conditioning units** in each home. Houses sell for $18,950 and $21,000 with 1,250 sq ft of floor area.

• The Atomic Energy Commission has approved the loan of **two tons of natural uranium** metal and a neutron source to New York University for use in constructing a facility for a nuclear engineering education program.

• Forecast for construction in 1956 is for **increases in all categories** of buildings except residential. Private construction for 1955 was 47% ahead of last year at mid-November.

• A new **School of Nuclear Science and Engineering,** operated for the AEC by Argonne National Laboratories near Chicago, opened its second session November 7 with 66 students. Of these, 45 are from foreign countries, 18 from U. S. industry, and 3 from AEC.

WASHINGTON OVERTONES

by LORING OVERMAN

With president Eisenhower back in the East, political overtones are beginning to again be heard in Washington. For a while after the President was stricken in Denver there were rumbling undertones, their significance inaudible. More recently the lines are being drawn in preparation for the return of Congress in January, and for the return of the political hunting season, come 1956.

Tax-wise, it will be a particularly busy season:

• Business, through the United States Chamber of Commerce, has voted on the 10 issues it considers most important; 4800 businessmen participated.

Tax revision and reduction were considered by 82.8% as being of first importance.

Federal and state **right-to-work laws** fell into an easy second place, with 72.6% of the votes.

Retention of **flexible price supports** for agriculture, third, claimed 58.3% of the votes.

Expanded **federal highway program,** fourth, 50.7%.

The question of whether **water resources** should be developed privately or federally was fifth, with 43.6% of the votes.

• **The five remaining issues,** in order:

Laws governing **welfare funds,** expanded **social security** coverage and rates, wider **minimum wage** law coverage, broadening of **federal aid** for school construction, elimination of control over independent producers of **natural gas.**

Businessmen are not alone in rating tax reductions tops among legislative overtones.

• With the politicos, the gavel which opens the second session of the 84th Congress is expected to start a novel **tax-reduction race.** The House, with virtually no unfinished business before it, may hear quickly from the Democratic-controlled Ways and Means Committee. Expected: a vote-wooing proposal to reduce taxes across the board at lower levels.

• The **Administration,** which normally would include tax discussions in the Presidents State of the Union and Budget Messages, may be pressured into some kind of a preview announcement of its **tax proposals.**

• Meanwhile, the calendar itself will exert sufficient pressure to keep tax matters on the move. The 52% **corporate** income tax rate, as well as certain **excise** rates, will be **reduced automatically** on April 1, 1956 unless extended. In addition, pending before the Senate are 25 tax bills already passed by the House.

Eighty panelists, among them the countrys leading economists and students of tax methods, will participate in **tax policy hearings** in Washington from December 5 to 16, inclusive. Hearings are scheduled by the Tax Policy Subcommittee of the Joint Congressional Committee of the Economic Report.

Purpose of the hearing is to study tax policy as it affects the stability and growth of the economy.

• On or before December 31, **business taxpayers** affected by the repeal of Sections 452 and 462 of the Revenue Code of 1954, must file a statement on a **new tax form** 2175 just issued. The sections relate to prepaid income and reserves for estimated expenses.

Increasing indications of a **boom economy** are causing varied overtones in Washington:

• Federal Reserve bank chiefs are still warning that **credit curbs** will be further **tightened,** and quickly, if the **upward** movement spirals too rapidly.

• Federal Housing officials says that the government will not hesitate to **loosen** credit restrictions at the first sign of a **slump** in home construction.

• Tax folks are building hopes of tax reductions on the expectation that next years **gross national product** will exceed $400 billion; thereby raising the tax take above current needs.

(*Continued on page* 8)

Metals are the Best Insulators

Against Heat, Cold, and Vapor in Building Spaces

The surfaces of ordinary IRON have about 4 times the reflectivity against heat rays that the surfaces of asbestos, asphalt, paper, brick, plaster, wood and other ordinary building materials have. Brass, gold, silver and ALUMINUM surfaces have about TEN TIMES the reflectivity against heat rays that these non-metallic materials have. Aluminum surfaces, for example, have a 97% reflectivity for RADIATION, whereas the surfaces of most building materials have a reflectivity of only 10%.

RADIATION (heat rays) is responsible for about 65% to 80% of all heat flow sideways in building spaces; 55% to 75% upwards; and 93% downwards.

Air space has low density, therefore heat flow by CONDUCTION through the **spaces** inside building walls, roofs, attics or floors is slight. CONVECTION can account for 15% to 30% of the heat flow sideways in such spaces, and up to 45% upwards. There is NO convection downwards.

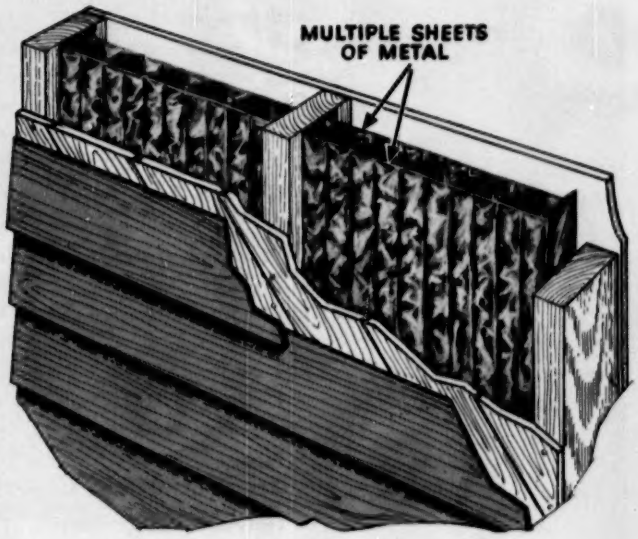
AN EXCELLENT HEAT AND VAPOR BARRIER

Multiple sheets of metal, spaced apart, make an excellent barrier to heat and vapor flow in any direction. Prefabricated Multiple Aluminum is installed in one simple operation. Tough metallic sheets are automatically expanded so as to form alternating layers of aluminum, fiber and low density reflective air spaces. The fibrous and metallic sheets retard inner and outer convection.

Its continuous metal sheets, up to 750 feet long, have almost zero permeability to water vapor. Infiltration under flat stapled flanges is slight. Condensation formation on or within this type of insulation is minimized by its scientific construction. More than 300 million square feet are in use today.

To obtain MAXIMUM, **uniform-depth** protection against heat loss and condensation formation, it is necessary to use the new **edge-to-edge** multiple aluminum*, **each** sheet of which stretches from joist to joist.

*Patent applied for.



FREE! RADIATION TABLE AND ASHAE BOOKLET

A very interesting and useful "Radiation Table" listing the Emissivity, Absorptivity, and Reflectivity of a long list of materials has been prepared by Alexander Schwartz, president of Infra Insulation, Inc. It is yours for the asking.

Also yours for the asking is a discussion of how and why aluminum insulates, even under extreme conditions. It will be found in the booklet, *Thermal Test Coefficients of Aluminum Insulation for Buildings*, published by the American Society of Heating & Air-Conditioning Engineers. A free copy and samples of the new insulation sent by us on request.

COST OF EDGE-TO-EDGE INFRA
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installed in new construction
between wood joists,
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WASHINGTON OVERTONES (*Continued from page 6*)

• Commerce Department spokesmen are cautioning businessmen "to take care and **not extend themselves** too far" if they want the national economy to remain sound and prosperous.

• To explore the impact of credit curbs on **housing construction,** public hearings were scheduled for November 28 by the Housing Subcommittee of the Senate Banking Committee. In announcing the hearings, Senator Sparkman (D-Ala.) chairman, cautioned that there are signs "federal credit restrictions may be jeopardizing the orderly growth of the home building industry."

Meanwhile, what of construction:

• During October the number of **requests for appraisals** of GI loans **declined** for the second month . . . this time 7% below September.

• For all construction, September's $4,048 million was the **highest spending** for any month in the country's history. October outlays of $3,903 million represent a seasonal drop from September, but remain the highest for any October . . . 11% above the same month in 1954.

• For **all of 1955,** the total promises to hit $42 billion—a gain of 12% over last year's $37.6 billion.

• **Housing starts** for this year are expected to total 1.3 million; next year 1.2—assuming credit restrictions ease a bit.

Defense Programs:

• **Military expenditures** for 1956 are now estimated at $34.5 billion, but those of Fiscal Year 1957 will be no less, Defense Department spokesmen predict. Although the program may not be enlarged, constantly increasing costs keep totals high.

• New military **construction guidelines** for fiscal 1956 and 1957 are detailed in Defense Department Instruction No. 4270.17, dated October 28, 1955. Approximately $500 million would be saved by following the guidelines explicitly, it is predicted. The new instruction gives the green light to only four types of construction; restricts expansion of recreational construction where some such facilities exist, and in the case of commercial and industrial facilities, restricts modification or expansion programs unless specifically authorized.

• Defense Department announced in mid-November, **plans to close** 32 more industrial or commercial facilities. This raises to 46 the list of facilities the Department plans to close in its efforts to eliminate competition with private industry.

• We may have to wait a little longer than was expected for completion of this country's first **space satellite.** Reports are that red tape and inter-service rivalries are delaying progress of "project vanguard," the satellite operation. Meanwhile Martin Aircraft of Baltimore has the contract to produce the satellite; General Electric the first-stage rocket-propulsion system.

• "Cabin Air-Conditioning and Wing Anti-Icing Temperature Control" is the title of a 470-page survey report released by the Office of Technical Services, (PB 111734, $7.00), Commerce Department, Washington, D. C. Combined thinking of major aircraft manufacturers, temperature control specialists and Air Force Research center.

Reminiscent of the controlled materials days of World War II and Korea is the **metals supply situation:**

• **Steel supply** picture is reported as nearly as acute as in 1952, and with much heavier demand in prospect when the St. Lawrence Seaway project gets under way. In prospect is some sort of a production directive system which would require mills to deliver rated shapes and forms, as well as the high-profit items which now prove so attractive.

• Only by **deferring stockpiling of aluminum** until further notice can industry supply the demand of manufacturers in this country and in the United Kingdom.

• **Nickel shortage** continues unabated, current suspicion being that production goals for nickel were set too low. During November and December 1,100,000 pounds a month of premium price ferro-nickel and nickel ingot will be **diverted to industry** from scheduled government shipments.

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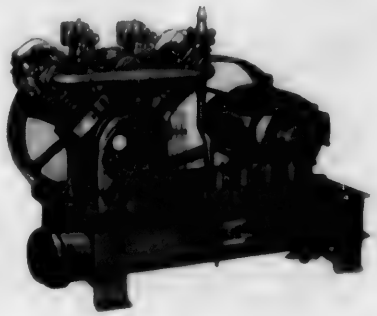
As we approach 1956 . . . our 50th Anniversary year . . . we pause only momentarily to salute the past.

Our idea of an Anniversary celebration is to make available to you the finest Air Conditioning Condensing Units in Brunner's history.

Look to Brunner in 1956 for the most complete air conditioning line . . . Condensing Units for remote installation . . . BAC package units for within-room or duct installation.

Brunner is your best 1956 buy for Bigger Profits!



BRUNNER MANUFACTURING COMPANY, Utica, N.Y.
The Brunner Co., Gainesville, Ga.
In Canada:
Brunner Corp. (Canada) Ltd., Toronto, Ontario

BRIEFLY STATED

• Don F. Zimmerman has assumed new responsibilities in the advertising department of Wolverine Tube, Division of Calumet & Hecla, Inc., according to H. A. Harty, advertising manager for Wolverine Tube. Formerly with the industrial engineering department in the Wolverine Tube Plant in Detroit, Mr. Zimmerman has been associated with the Company for the past eleven years. He will be located in the firm's general sales office in Detroit.

• Notice is given of the death of H. L. MacElroy, general sales manager of Springfield Boiler Co., Springfield, Illinois, who was stricken suddenly on October 17 and succumbed almost immediately thereafter. Mr. MacElroy had had more than twenty-five years of experience in the steam generating and fuel burning fields.

• The A. W. Cash Co. of Decatur, Ill., has purchased the business of the Farris Stacon Corp., Palisades Park, N. J., manufacturers of temperature control valves. The A. W. Cash Co. manufactures the Cash Standard line of valves, controllers, governors and regulators. The new product line will be known as Cash Standard Stacon, instead of Farris Stacon. Operations of the Farris Stacon Corp. will be transferred to the Decatur plant.

• The directors of York Corporation have elected R. K. Serfass and R. F. Lauer new directors, according to an announcement made by Stewart E. Lauer, president. At the same time the resignations tendered by E. A. Kleinschmidt and C. A. Olsen as directors were accepted.

• Samuel P. Felix, general manager of the De Laval Turbine Pacific Co., was named vice president by a recent meeting of the board of directors, according to an announcement by J. P. Stewart, president of the De Laval Steam Turbine Co., Trenton, N. J. Turbine Pacific is a wholly-owned subsidiary of De Laval in Trenton. Mr. Felix, in addition to his new post as vice president, will continue to serve as general manager.

• Appointment of Anthony J. DeFino, of Buffalo, N. Y., to the top position in the air conditioning division of Servel, Inc., has been announced. For the past six years DeFino has been vice president and general manager of Fedders-Quiggan Co., of Buffalo, manufacturers of room air conditioners, commercial refrigeration parts, automotive radiators and oil coolers, and cartridge cases.

• Lyle C. Harvey, senior vice president of Carrier Corporation, Syracuse, N. Y., was elected a director of the American Gas Association at the 37th Annual Convention of the Association in Los Angeles. Mr. Harvey, who has previously served on the A.G.A. board of directors, was elected for a two-year term ending in October, 1957.

• C. A. Murchison has been appointed by Armstrong Furnace Co. as manager of industrial sales.

• Appointment of Howard K. Beck as president of the Jackson and Church Furnace Division of the Norbute Corp. has been announced. It was announced at the same time that F. C. Adams has been appointed vice-president of the division. Both men have been associated with Jackson & Church since 1946.

• Cory Corporation has purchased all capital stock of The Mitchell Manufacturing Co. Purchase price was not disclosed but assets of the Mitchell company were estimated to be in excess of $3 million. The Mitchell company will continue to operate as it has in the past, but as a wholly-owned subsidiary of Cory, competitive with Corys Fresh'nd Aire division. B. A. Mitchell will step down as active head of the company bearing his name but will serve Cory in an advisory capacity.

• Election of Arthur M. Kiely as treasurer of Buffalo Forge Company has been announced. Mr. Kiely, who is also a vice president and a director of the Company, assumes the additional post of treasurer previously held by Edgar F. Wendt, president. He has been associated with Buffalo Forge since 1930 prior to which he had been with the national accounting firm of Ernst & Ernst.

• Announcement of the formation of the Bituminous Pipe Institute, a trade association which will serve as the spokesman for leading bituminous pipe producers of the country, has been made. Among the members of the Bituminous Pipe Institute are Brown Company, Berlin, N. H., Line Material Company, Milwaukee, Wisc. and Orangeburg Manufacturing Company, Orangeburg, N. Y. Headquarters of the new organization are at 370 Lexington Avenue, New York 17, N. Y. Frank H. Baxter Associates will serve as managers of the Institute.

• Typhoon Air Conditioning Co. and Hupp Corp. are to merge, according to a joint statement by Don V. Petrone, president of Typhoon, and John O. Ekblom, chairman of the executive committee of Hupp. Hupp manufactures air conditioning equipment, electronic equipment and sub-assemblies for the automotive and aircraft industries. Recently Hupp Corporation merged with Perfection Industries, Inc. Typhoon manufactures residential and commercial packaged air conditioning equipment.

• Harold J. Barnes has joined the residential sales department for the Unitary Equipment Division of Carrier Corp. Mr. Barnes reports to William A. Lake, residential sales manager, and will be responsible for the promotion of Carrier residential equipment in the field. A native of Chicago, Ill., Mr. Barnes attended the University of Chicago, receiving a master's degree in business administration in 1947.

• Fairbanks, Morse & Co., Chicago manufacturers, has announced the election of Robert D. Brown as assistant secretary and assistant treasurer of the corporation. Mr. Brown joined the Fairbanks-Morse organization in 1953, having formerly been associated with the Richardson Co. and the International Harvester Co., both of Chicago.

• C. Adrance Montague, formerly general sales manager, Kalamazoo Furnace & Appliance Mfg. Co., Kalamazoo, Mich., has joined York-Shipley, Inc., York, Pa., as manager of residential air conditioning sales. Mr. Montague has had a long experience with air conditioning sales. Before he went to Kalamazoo, he had served in sales and managerial capacities with Carmen Air Conditioning Corp., Syracuse, N. Y.; Chrysler Airtemp, Syracuse; and McShain-Carrier Corp., Philadelphia.

• The General Electric Home Heating and Cooling Department has announced the appointment of R. R. Routh, Jr. as manager, advertising and sales promotion. Mr. Routh has had a number of years of similar experience with Carleton-Stuart Corp., Carrier distributor in New York.

St. Genevieve's School goes all the way with Sill-line Radiation

teammates...

Sill-line's beauty and comfort are important aids to the enjoyment of daily life

Today's most versatile form of perimeter heating is the dependable ally of designers and builders of churches, schools, hospitals and offices

Sill-line fits this structural condition with ease and grace

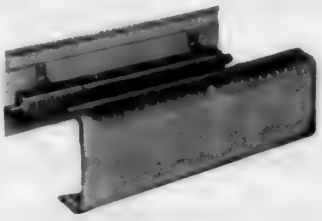
Architect, contractor and manufacturer team up through Nesbitt Sill-line Radiation to provide an indoor thermal environment conducive to comfortable living—work, play, study, and worship.

Sill-line is a perimeter type of high-capacity fin-and-tube radiation housed in a beautiful casing that fits any occasion and enhances the modern interior.

It will pay you to put Sill-line on your team.

Only Nesbitt Sill-line Radiation with its full one-piece back could fit with economy this mullioned wall-skin construction

Quick and easy to install!
Full one-piece back for true and rigid alignment; needed accessories to eliminate all cutting; 16-gauge enclosures; baked enamel finish, choice of colors. Five casing styles; seven lengths; eight heating elements, steam or hot water; approved ratings, 2.9 to 12.1 sq. ft. EDR.



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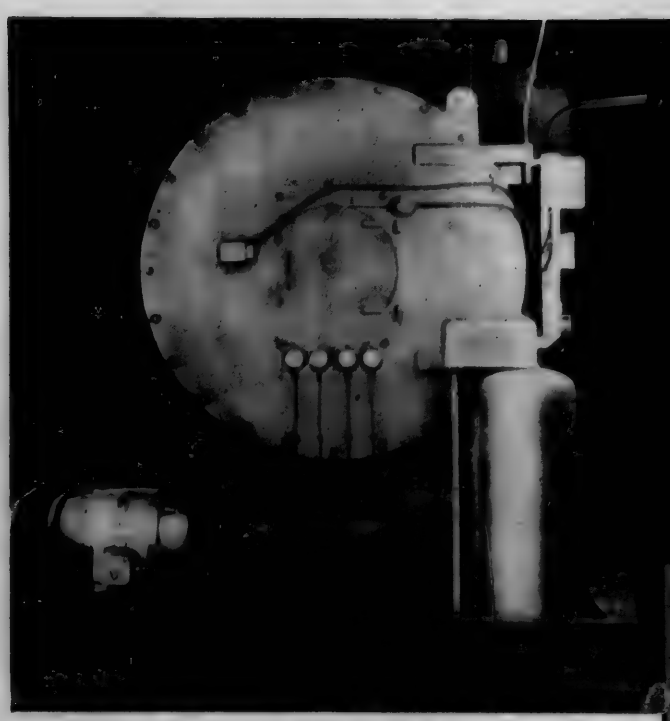
Nesbitt
SILL-LINE RADIATION
Made and sold by JOHN J. NESBITT, INC., Philadelphia 36, Pa.



225 hp York-Power Steam Generator in Arvin Industries Inc. Plant.

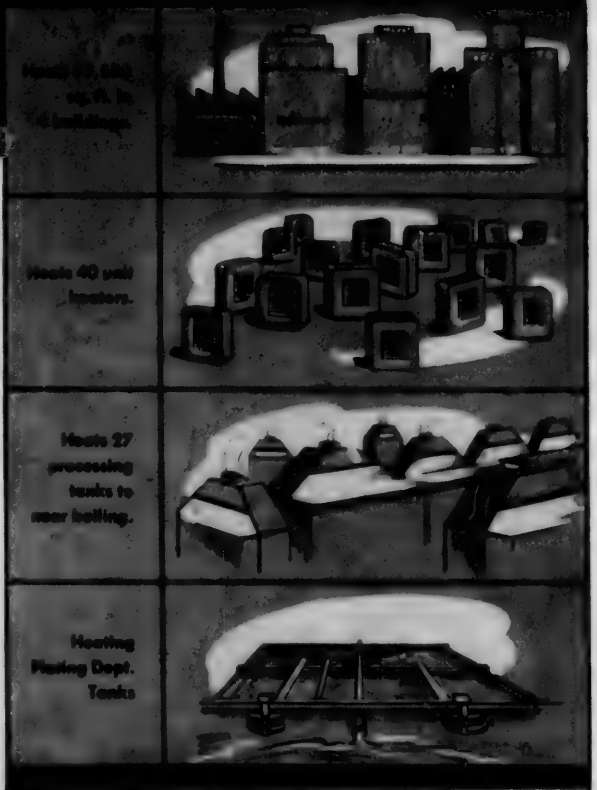
THIS VERSATILE GENERATOR SOLVES PLANT HEATING AND PROCESSING PROBLEMS, TOO!

One York-Power Steam-Pak generator carries entire heating load of big Arvin Industries Inc. plant

The Arvin Industries Plant at North Vernon, Indiana was bothered with dust and grit from inefficient, coal-fired heating equipment. To overcome this, they installed a 225 hp, 15 psi, YORK-POWER Oil-fired Steam-Pak generator.

This one generator now takes care of their *entire* heating load, including 40 unit heaters located in four buildings . . . a total of 91,000 sq. ft. of floor space. In addition this York-Power generator heats 34,000 gallons of water, in 27 processing tanks, as high as 212°F. Steam from this generator is also used to distill water for mirror-silvering operations.

As a result, Arvin has eliminated their coal dust problems, enjoys far greater heating efficiency, and a worthwhile economy, too. Find out how YORK-POWER units can serve and save for you. Your nearest York-Shipley Representative will give you full details. Call him today.



ONLY YORK-POWER HAS ALL 4

Industrial Division

YORK-SHIPLEY, INC.

YORK, PENNSYLVANIA

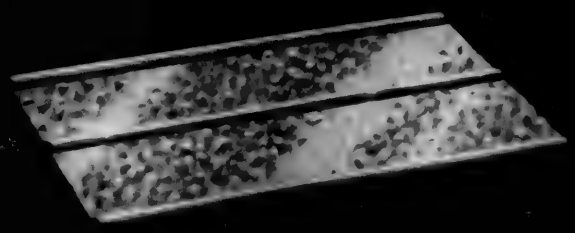
WEIRTON

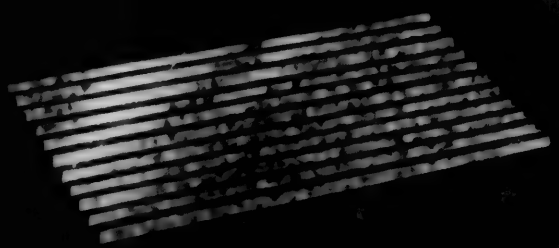
GALVANIZED SHEETS

for long-lived roofing and siding

There's an easy way to solve roofing and siding problems quickly, dependably, economically. That's the Weirton way—with Weirton galvanized steel sheets. Their tight zinc coating resists cracking, peeling and flaking. The strength of steel plus the corrosion resistance of zinc gives added years of life. And long experience shows that galvanized sheets give more protection, with less maintenance and at lower cost.

Weirton's modern production processes, plus close quality control all along the line, make Weirton galvanized sheets a best buy for your roofing and siding needs.

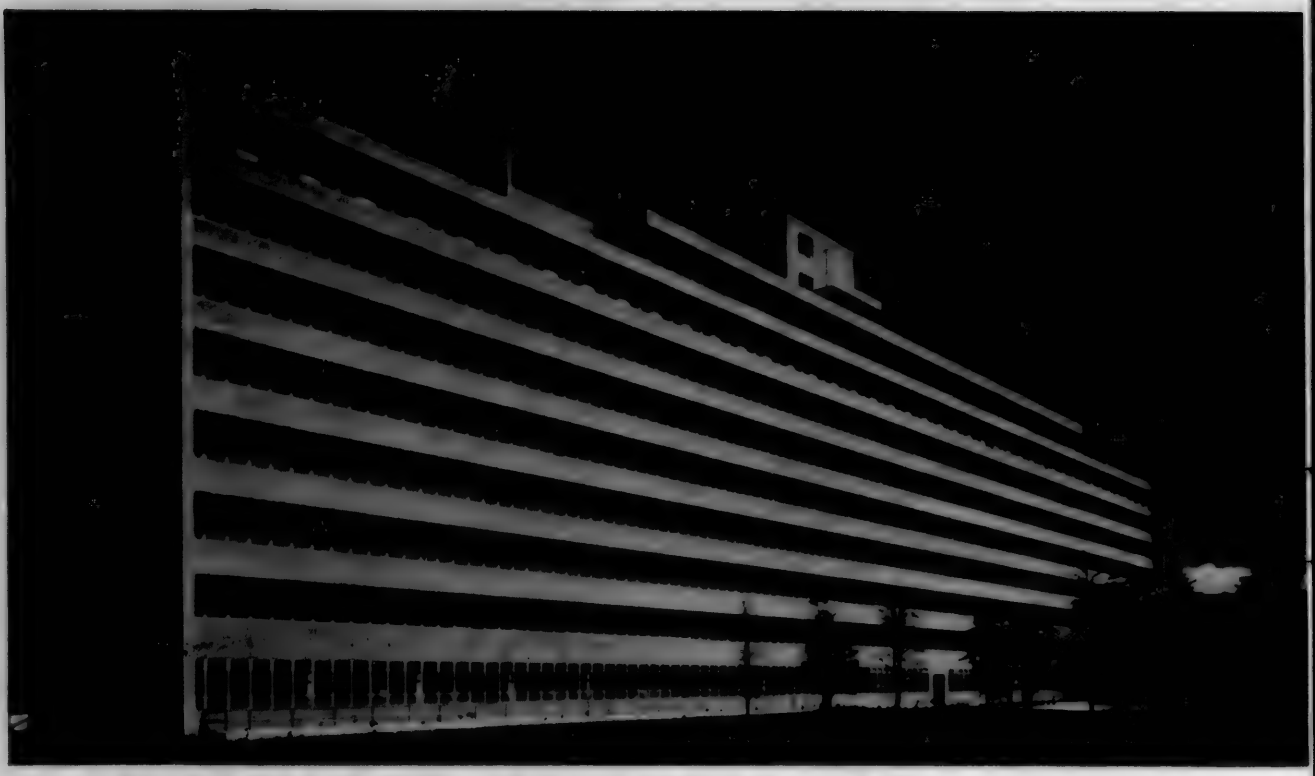




WEIRTON STEEL COMPANY

Weirton, West Virginia

NATIONAL STEEL CORPORATION



Veteran's Hospital, Seattle, Washington. *Equipped with B&G Pumps.* Architects: *Naramore, Bain, Brady and Johanson, Seattle.* Engineers: *Bouillon and Griffith, Seattle.*

For heating or cooling water

For all-year comfort conditioning, the advantages of water have made it the preferred medium. The quality of the equipment used to heat, cool, and circulate water, therefore, becomes of major importance to the designing engineer.

B&G presents a line of equipment specifically designed to meet the exacting requirements of a satisfactory water system. The B&G Universal Pump, for example, with *noise and vibration engineered out*...velvet-smooth in operation. For cooling, the B&G Package Liquid Cooler offers a completely integrated unit, alive with features for more economical performance, easier installation. And for the many applications where water-to-water or steam-to-water heat transfer is required, B&G Heat Exchangers provide large capacity in compact, efficient units.

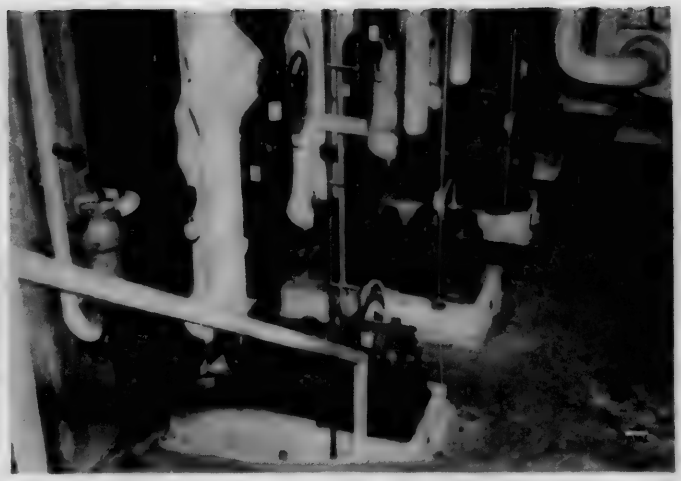
If you haven't a complete file of B&G literature on heating and cooling equipment, write today. Remember, too, that the B&G engineering staff is always available for consultation.

BELL & GOSSETT
COMPANY

Dept ED-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, W. Toronto

B&G Package
Liquid Cooler
An engineering achievement which challenges comparison! Built in capacities from 5 to 150 tons, these units incorporate many special features as standard equipment. Completely self-contained...virtually a plug-in unit. Send for Bulletin HB-755.
B&G Type "HE"
Heat Exchanger
An extremely versatile, instantaneous water heater with a wide range of applications. It is equipped with a B&G Booster Pump, which circulates boiler water through the shell under thermostatic control. Pumped circulation plus efficient internal design, enables a comparatively small unit to produce a large volume of hot water.



- **Apartment Building, Chicago, Illinois** (*upper left*). *Quiet B&G Universal Pumps are used to boost city water pressure.*
- **Illinois Institute of Technology faculty apartments, Chicago** (*lower left*). *Equipped with B&G Universal Pumps and Heat Exchangers.* **Architects:** *Mies van der Rohe, Pace Associates, Associated, Chicago.* **Heating Contractor:** *Wm. A. Pope Co., Chicago.*
- **Combination heating-cooling system** (*above*). *B&G Universal Pumps circulate heated and cooled water through the same piping system.*

and circulating it ***Noiselessly***

B&G Universal Pumps

In every detail designed and built for *silent, vibrationless* operation!

The motor is specially constructed, tested and *hand-picked* for quietness. Sleeve bearings in both pump and motor...suspension in ring-type rubber mountings and flexible spring couplers, all contribute to velvet-smooth performance.

Other features include the diamond-hard, leak-proof "Remite" Seal, oil lubrication and hydraulically balanced impeller. The removable bearing frame permits servicing without breaking pipe connections—*all the advantages of split case design!*

B&G Boosters

Famed for quietness—for efficiency—for long life! B&G Boosters are offered in a wide range of sizes for applications requiring less head and capacity than provided by B&G Universal Pumps. Widely used for residential heating, snow melting systems, circulating service water and as secondary pumping units in larger installations. *Over 2,000,000 B&G Boosters have been sold to date!*

Photograph shows a section of the Langley-Bath Clearwater High School, located at Bath, Aiken County, S. C. It received design awards in the AASA-AIA School Building exhibition and the South Atlantic AIA Regional Honor Awards Program and from the School Executive magazine.

Lyles, Bissett, Carlisle & Wolff, architects.
E. M. Spong Construction Co., general contractor
W. O. Blackstone & Company, plumbing and heating contractor.
All of Columbia, South Carolina.

YOUNGSTOWN PIPE installed in award-winning school

The planners of this school looked toward the future and specified pipe that will insure adequate protection to the radiant heating system for years to come. For years to come, because Youngstown Pipe is made only of the finest steel. Its quality is closely controlled from ore mine right through to the final threading operation.

The 7 points of uniform goodness in Youngstown Pipe add up to the fact that you can't go wrong with Youngstown. Be sure it is specified on your next order.

Having Problems?

For information and service, get in touch with the local distributor of Youngstown Steel Pipe—or phone our nearest District Sales Office.

7 reasons why YOUNGSTOWN PIPE was selected

1. Uniform Ductility
2. Uniform Lengths
3. Uniform Threading
4. Uniform Weldability
5. Uniform Wall Thickness and Size
6. Uniform Strength and Toughness
7. Uniform Roundness and Straightness

Youngstown

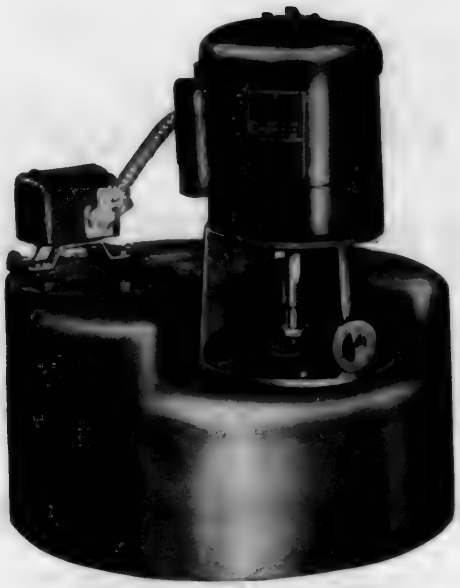
STEEL QUALITY YOUNGSTOWN SERVICE PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown, Ohio District Sales Offices in Principal Cities

SHEETS · STRIP · PLATES · STANDARD PIPE · LINE PIPE · OIL COUNTRY TUBULAR GOODS · CONDUIT AND EMT · MECHANICAL TUBING · COLD FINISHED BARS · HOT ROLLED BARS · WIRE · HOT ROLLED RODS · COKE TIN MILL PRODUCTS · ELECTROLYTIC TIN PLATE · BLACK PLATE · RAILROAD TRACK SPIKES · MINE ROOF BOLTS



For Top Performance - SKIDMORE HAS NO EQUAL!

"CV"
VERTICAL PUMP
Single Unit

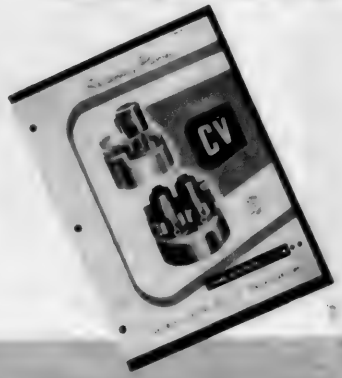
Duplex units are built with either the two float switches or automatic alternator.

The Skidmore "CV" Vertical Pump can do the job—in less space and at lower cost! Its top performance has earned the respect and confidence of the critical engineer and contractor. Pump is bronze fitted throughout . . . shaft is stainless steel . . . self-lubricating bronze bearing directly above impeller insures proper alignment and longer service

CHECK THESE ADVANTAGES

- **Available in capacity range from 500 to 10,000 sq. ft. E.D.R. and discharge pressures from 10 to 40 lbs.**
- **Featuring mechanical shaft seal—eliminates any possible leakage from pump shaft.**
- **Inspected easily, without disturbing piping.**
- **Compact and rigid — requires only a space 15" x 15" x 22" for unit shown above.**
- **Receiver can be installed on floor level or in pit — has lowest possible receiver inlet opening.**
- **Cast iron receiver — for longer wear.**

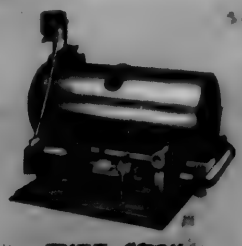
NEW BULLETIN
Complete engineering data and capacity tables are yours for the asking . . . send for bulletin No. 21-B.



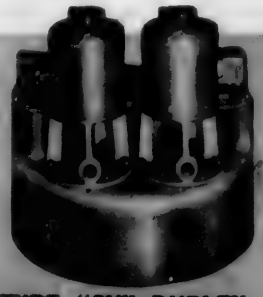
SKIDMORE CORPORATION, ST. JOSEPH, MICHIGAN

SKIDMORE PUMPS

TYPE "UV"



TYPE "RB"



TYPE "CV" DUPLEX

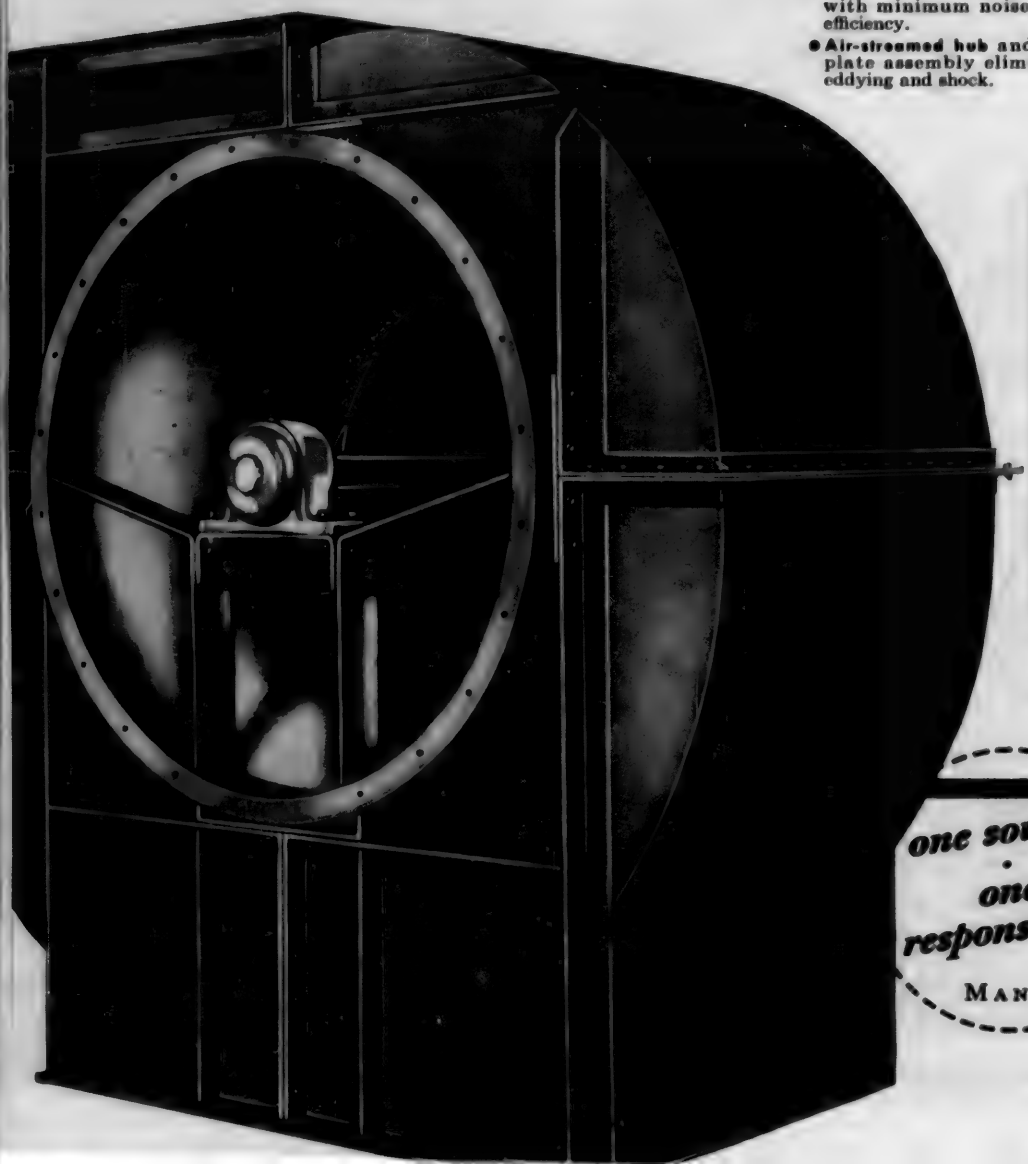
Trane Fans and Coils have more features that give you

Greater efficiency . . . compactness in your built-up

Handle bigger jobs with more compact equipment . . . get greater reliability, too!

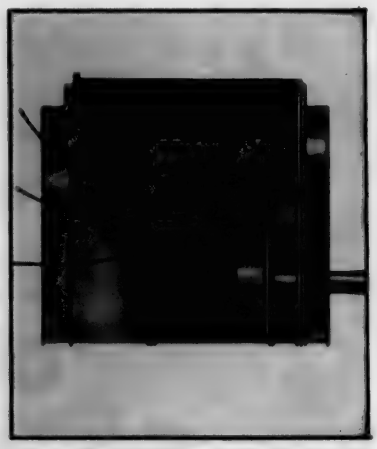
The efficiency features of TRANE Fans and Coils can make a *big* difference in your built-up systems! For example, the TRANE Delta-Flo Fin and mechanical fin-to-tube bond not only give you a more *efficient* coil, but actually form a stronger, more rigid unit than heretofore possible. And even that is only part of the story.

TRANE Centrifugal Fans available in 81 types in all sizes through 109", FC types through 89". Utility fans 4" through 30". Propeller fans 10" through 46".



Compare Trane with any other fans

- **True non-overloading** power characteristics, moderate rotative speeds.
- **Special housing** and outlet shapes handle large volumes with minimum noise, high efficiency.
- **Air-streamed hub** and back plate assembly eliminates eddying and shock.
- **Fan wheel balanced** dynamically and statically with electronic balancing equipment.
- **Rugged housing** of lock-seam construction (small fans), welded construction (large fans) resists damage.
- **Proved performance** backed by over a quarter of a century of fan building experience.



Streamlined inlet cone distributes air evenly in fan wheel without noisy turbulence. Permits fan to operate at high efficiency with low noise level.

one source • one responsibility

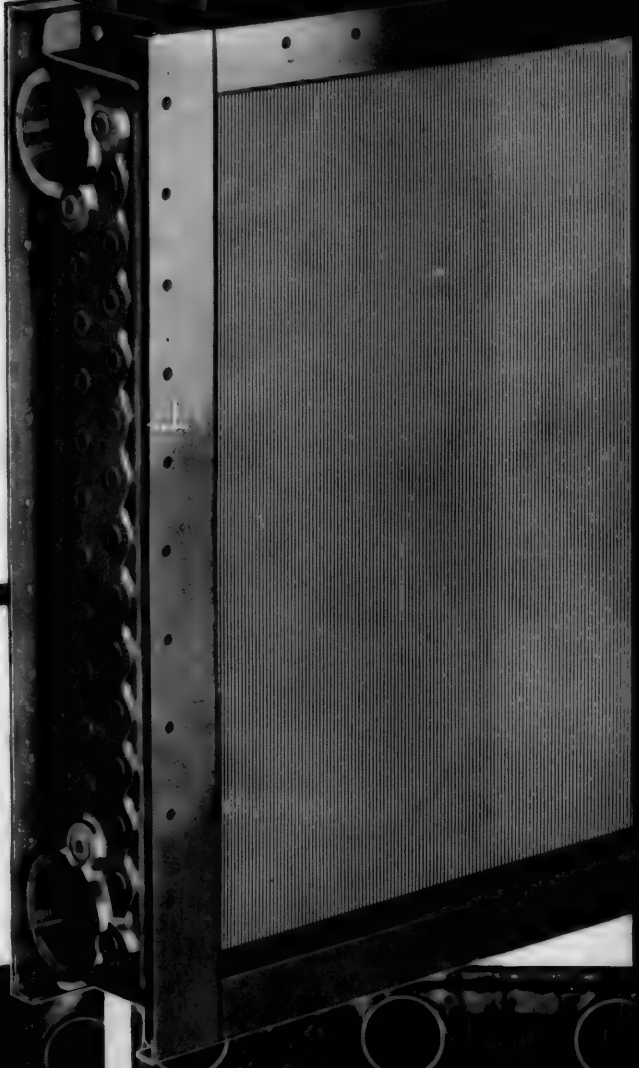
Install

MANUFACTURING ENGINEERS

The Trane Company,

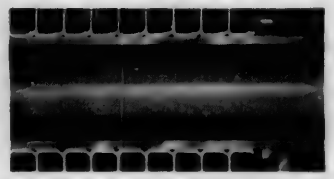
durability... systems

Every TRANE feature—from the accurately streamlined fan inlet to the exclusive kinetic orifice—has been *proved in actual application*. You know you can count on TRANE Fans and Coils for efficiency, durability and compactness *before* you order! For details see your nearest TRANE Sales Office or write TRANE, La Crosse, Wis.

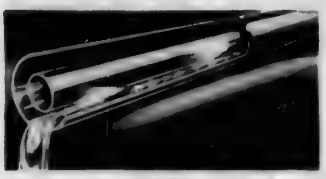


Compare Trane with any other coils

- **Accurate ratings** proved by over twenty-five years of field and laboratory testing.
- **Exclusive dual fin** contact assures high heat transfer, greater strength.
- **Greater rigidity** assured by the formed delta ridge of the new Delta-Flo Fin.
- **Low air friction** of plate type fin offers minimum air resistance.
- **High coil capacity** yet wide fin spacing.
- **25% more effective** use of the fin surface.
- **More uniform heat** transfer over entire surface of the fin.

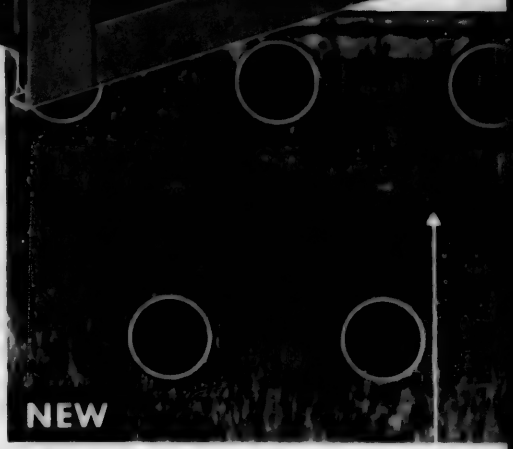


Mechanical fin-to-tube bond is as strong as though fin and tube were one. Wide, flat collar forms generous heat transfer area.

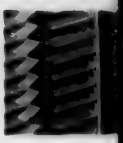


Kinetic orifice on SD coils releases steam in the direction of the condensate flow. Accelerates condensate flow, guards against freezing, provides more uniform temperature distribution on modulated control.

Old plate fin. With flat fin design, turbulence is concentrated behind each tube as shown by this unretouched laboratory test photo. Since turbulence is concentrated, a large part of the fin area produces little heat transfer.



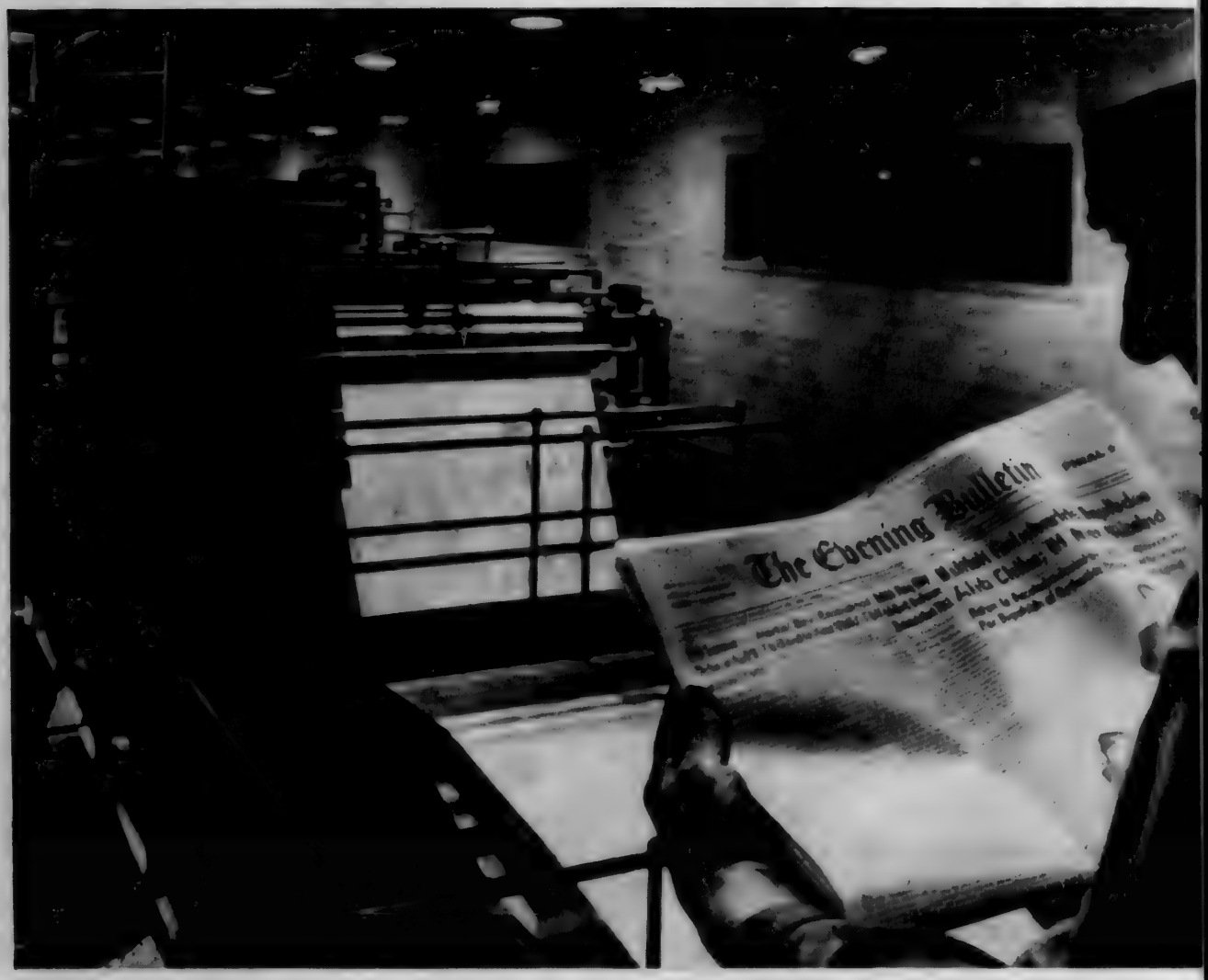
New Delta-Flo Fin. Delta-shaped ridge just ahead of each row of tubes extends turbulence over *entire fin surface* for uniform-heat transfer. Unretouched test photo shows how every inch of fin surface contributes to heat transfer.



TRANE Fans and Coils *for efficient built-up systems*

OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa. • Trane Co. of Canada, Ltd., Toronto • 90 U.S. and 15 Canadian Offices



Pressman checks a final copy in controlled humidity of the press room.

Men and machines bring news to you

American Blower plays vital role in air conditioning one of the world's largest newspaper plants

At the new building of The Philadelphia Evening and Sunday Bulletin, gigantic newspaper printing presses reel off 210,000 newspapers an hour . . . in an atmosphere controlled by American Blower equipment.

A relatively high humidity in the press room is a must – for the speeding miles of paper could tear if too dry, and cause a delay. This added moisture, precisely controlled, also improves printing. The stereotype section, however – where lead printing plates are cast – calls for different treatment. Here, American Blower ventilating equipment works 'round the clock to rid the area of heat generated by the metal pots.

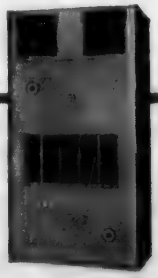
Considered by many as "the mechanical showcase of modern journalism," the new Bulletin Building requires varied air conditions throughout its over 500,000 sq. ft. area. For cooling, heating, ventilating, air filtering, humidifying, and dehumidifying – both men and machines depend on 78 American Blower units in the race of getting news to readers faster.

You can count on American Blower, too . . . whether your air-conditioning needs are large or small, normal or unusual. Just phone our representative near you.

New Bulletin Building. Architects: George Howe & Robert Montgomery Brown. Mechanical Contractors: Riggs Distler & Company, Inc. Special Consultants: William Ginsberg Associates. Consulting Engineers: A. Ernest D'Ambly; Pennell & Wiltberger; Keast & Hood.

In the section where printing plates are made, there is 'round-the-clock ventilation . . . to exhaust heat generated by the melting and casting of lead.

faster—thanks to conditioned air



In addition to equipment for complete central systems—American Blower offers packaged air conditioners for offices, stores, industrial plants, and similar applications.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American-Standard

AMERICAN BLOWER

Air-conditioning equipment for every business

Ventilation Problems: Gone with the Joy Axivane Wind

Compact Joy installation at Boqueron, Venezuela, moves huge quantities of air.

Joy Axivane design means power savings at Alcoa's Texas Plant.

Space-saving Joy fans are installed as part of the duct system at Reliance Electric's Ohio Plant.

Dependable Joy installation circulates freezing air in California Cold Storage Plant.

'Round the World, JOY Handles the Hard Ventilating Jobs

Joy handles the hard jobs in ventilation round the world because a Joy fan develops greater volume of air per pound of fan and motor—because of simplicity of installation that eliminates duct offsets, elbows, drives and guards. The JOY Axivane fan is a favorite of ventilating engineers because JOY installations save up to 70% of the space occupied by other fans of equivalent performance. This space-saving feature of Joy fans makes possible more profit-making production area.

An Axivane fan is an integral part of the duct in which it is installed. Pre-lubricated, double-shielded ball bearings permit the fan to be installed in any position—give you long service without attention. These precision air-moving machines are marvels of efficiency and compactness. They provide economical, efficient air circulation for all types of commercial and industrial applications.

You can choose from a standard line of over 136 models specially designed to meet the needs of modern industry. The Joy Axivane Series 1000 is a standard line available to you ready for installation.

For complete information about the JOY standard line of 136 models—to learn about JOY custom engineering service, write to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario*

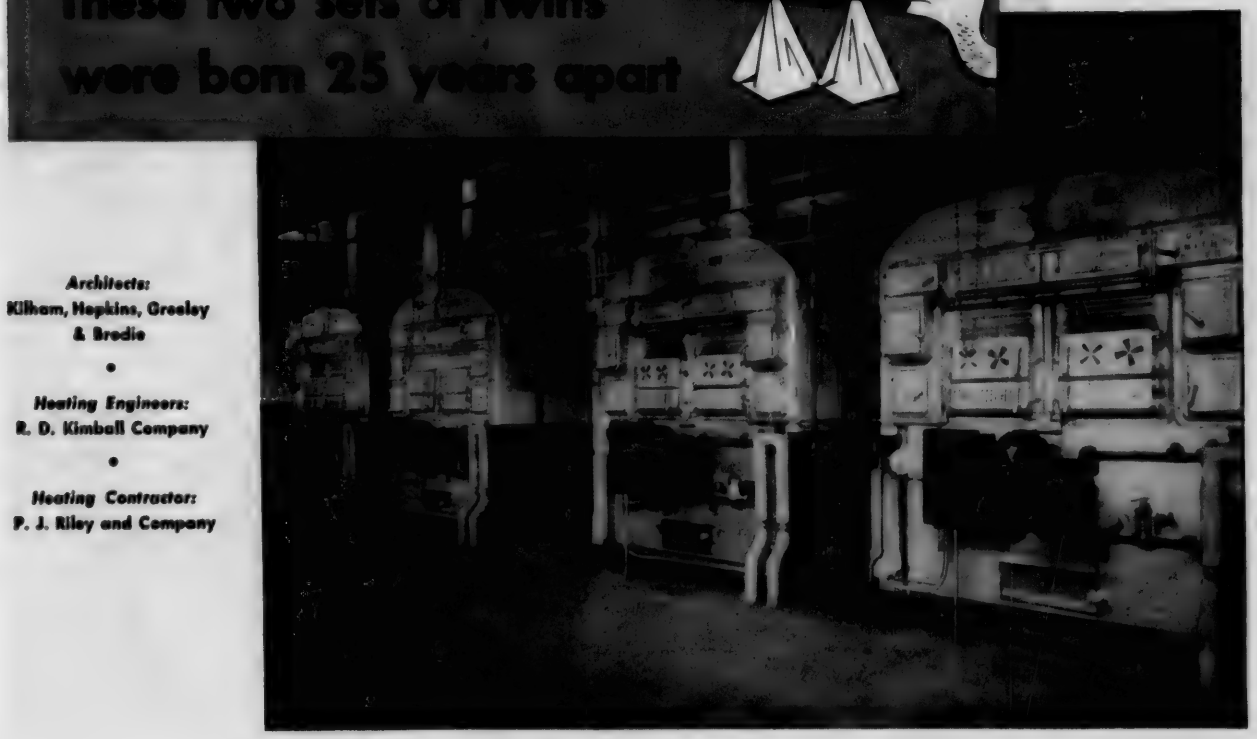
Write for FREE Bulletin 17-40

JOY

WORLD'S LARGEST MANUFACTURER OF VANEAXIAL-TYPE FANS

WAD 15940-17 *Consult a Joy Engineer*

These two sets of twins were born 25 years apart



Architects:
Kilham, Hopkins, Greeley & Brodie

•

Heating Engineers:
R. D. Kimball Company

•

Heating Contractor:
P. J. Riley and Company

Which twins are the older?

Needham, Massachusetts, *looked ahead* 25 years ago — *and looks ahead today.* It is one of the fastest-growing communities in the State. And — like so many other towns — it has had to face the future *now.*

25 years ago, its new high school building appeared adequate for many years to come. And, *looking ahead at that time,* to long-term economy of fuel and low maintenance costs, the town invested a few extra dollars in the best boilers available — two 20-section 60 Smith Cast Iron Boilers for coal-burning.

In 1954, the town decided to double the capacity of the original building. Specifications called for two new 60 Smith oil-burning boilers and conversion of the older boilers to oil.

To determine the condition of the old boilers, the engineers decided that a careful examination should be made, and as the bridge wall sections were not to be used after conversion, they were broken and examined. Present at this inspection were representatives of the architect, heating engineers, heating contractor, insurance company and The H. B. Smith Co.

The sections showed even thickness of fine gray iron with no appearance of deterioration. Since these sections were located in the hottest part of the boiler, subject to the greatest wear, it was the unanimous opinion of those present that the town would be wise to use the old boilers along with the new ones.

The installation has now been through its first winter, and never at any time have more than three boilers been on the line, despite the fact that the heating load calls for the fourth boiler when necessary.

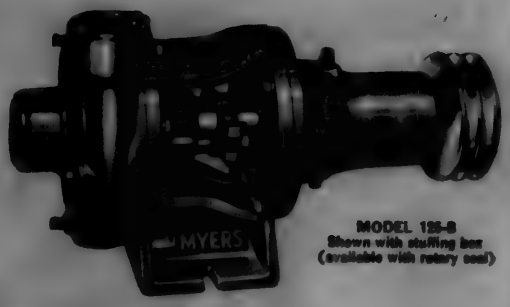
If Needham, back in '29, had "saved money" with a "20-year boiler," the town today would be *out* many thousands of dollars — in added maintenance, extra fuel and the new capital investment needed.

Now, because the town *looked ahead* in 1929, it can *look ahead* in 1955 to many, many more years of efficient heating service from its dependable two sets of twins. And the money saved can be spent where it's vitally needed today — *educating children,* not feeding, maintaining and replacing boilers.

H.B. *Smith* CAST IRON BOILERS

THE H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • Established 1853

MODEL 125-M
Shown with stuffing box
(available with rotary seal)



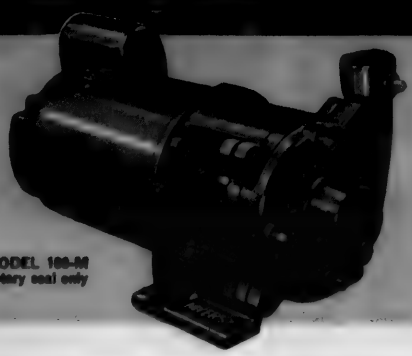
MODEL 125-S
Shown with stuffing box
(available with rotary seal)

NOW...a complete line

of centrifugal pumps for air conditioning from...

MYERS

MODEL 100-S
Rotary seal only



MODEL 100-M
Rotary seal only

FULL RANGE OF SIZES
⅓, ½, ¾, 1, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1" x 1¼" or 1¼ x 1½".

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

ROTARY SEAL
Eliminates leakage (stuffing box may be specified on "125" models.)

CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

WIDE RANGE OF CAPACITIES AND HEADS
Capacities to 90 GPM. Heads up to 135 feet.

Write today *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

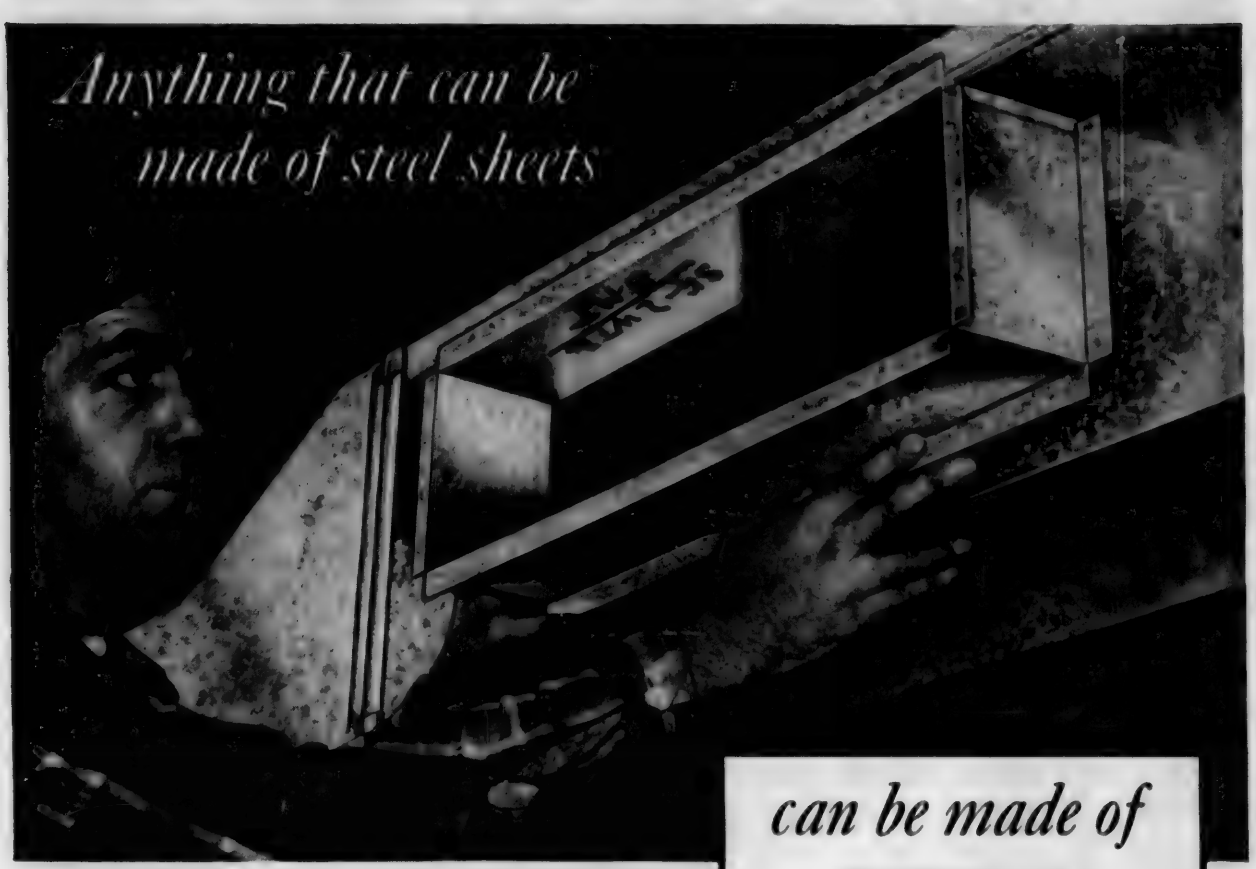
Myers

PUMPS WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co., Dept. HV-12, Ashland, Ohio

A CHALLENGE!

THE STRONGEST MADE BY ANY GALVANIZED SHEET:



can be made of

WHEELING

SOFTITE

galvanized sheets

- Take all the ideal working qualities you have ever hoped for in a galvanized sheet . . . put them all together and you'll get some idea of the amazing workability of Wheeling SOFTITE Galvanized Sheets.

  Here is a soft, ductile sheet, with the tightest zinc coating yet produced . . . so tight, in fact, that you can use Wheeling SOFTITE to make anything you make of steel sheets.

  If *you've* been having difficulty using customary galvanized sheets, try Wheeling SOFTITE. So many users have acclaimed it the ideal galvanized sheet that Wheeling is tripling its SOFTITE production facilities in 1955.

  Get details today. Call or write the Wheeling sales office nearest you. Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL

DISTRICT SALES OFFICES

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HOUSTON NEW YORK PHILADELPHIA ST. LOUIS SAN FRANCISCO WHEELING

Modine Convectors
30 types, 8000 sizes
There's a Modine Convector to meet your exact needs: Deluxe, standard and institutional models—free-standing, fully and partially recessed, concealed and wall-hung types with many design variations. Model shown above is a Type F, fully recessed.

Smartest buy—three ways!

1. IMPROVE ROOM APPEARANCE

Modine Convectors replace unsightly radiators . . . lend smooth, classic-modern appeal to every room. And they're finished to "take" paints that match any decor. Also, Modines retain "new look" for years because of special bonderizing process.

2. INCREASE OCCUPANT COMFORT

Modine Convectors assure gentle circulation of warm air. There are no drafts, no hot spots near the convector, no cold spots in the far corners. And, because they are individually controlled, they can easily be set to suit the occupant's express wishes.

3. SAVE THE BUYER MONEY

Considering the many advantages they offer, Modines are remarkably low priced. And—they offer years of efficient, inexpensive heating at nominal cost for maintenance. Each Modine, regardless of its price bracket, is craftsman built with quality materials.

R-1289

For complete details, contact the Modine representative listed in the classified phone book or write Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis.

Modine

CONVECTOR RADIATION

HOFFMAN MAIN VENTS

No. 75 STEAM

The steam main must be hot first so that the heating system will get the maximum amount of heat in the miminum amount of time. The No. 75 vent with its large venting capacity lets the air out of the main permitting the heating units to function at their greatest efficiency.

Size connection ¾" male, ½" female. Max. operating pressure 10 lbs.

Steam Unit Heaters must be "piping hot" to give best results. The smallest amount of air must be eliminated as fast as it accumulates. The No. 74 vent was designed to meet the unusual air problems in steam unit heaters. This vent will operate with rising, dropping or steady pressure.

Vents 300 Cu. In. of air per minute at 1 lb. and 800 C.I.M. at 10 lbs. Size Conn. ¼" male, ½" female. Max. Operating Press. 50 P.S.I.

No. 79
WATER VENT

For good circulation on any water system it is necessary to let the air out. The No. 79 with its special float mechanism and rugged construction vents the air from the mains on Hot Water Heating Systems—Domestic Water Systems—Summer-Winter Units—Industrial Processes.

Tapped at the top for ¼" pipe connection to conduct away moist air.

Max. Operating Press. 75 P.S.I. Size Conn. ¾" male, ½" female.

To get top performance on Steam Unit Heaters, Steam Heating Systems, Steam Process Work, Hot Water Heating Systems, Domestic Water, Summer-Winter Units—Water Process work, air must be eliminated from the mains. The "Hoffman Big 3 Main Vents" are designed to vent the air accumulations in the main so that the equipment will function effectively.

Installation of these main vents now on old or new jobs will insure the maximum efficiency of the equipment.

HOFFMAN MAIN VENTS

HOFFMAN SPECIALTY MFG. CORP.

VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS

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Sold by leading Wholesalers of Heating and Plumbing Equipment

Most promising word in air conditioning control today is electronics. Electronics has brought new techniques, new terms, new questions. ***How important is outdoor compensation? Is automatic sequencing practical for buildings of any size? What about averaging?*** *Here are the answers—in the first of a series of reports from the pioneer manufacturer of electronic controls.*

Electronic Temperature Control

More than 5,000 Honeywell installations have shown electronics to be the most flexible system for any commercial building; it gives better control, more convenience, at less cost.

Honeywell Electronics
Report Number One

HONEYWELL built the first electronic thermostat only half a dozen years ago.

Since then, electronics has become the most exciting concept in the field of commercial heating, ventilating and air conditioning control. The mystery is gone: more than 5,000 working installations by Honeywell alone are proving the value of electronic temperature control to engineers, architects and building management from coast to coast.

You'll find the up-to-date story of electronic control profitable to know—because there's plenty of evidence that electronics is rapidly setting a new standard in the industry.

Developers of the electronic thermostat were looking for better temperature control. They found it—in a small coil of wire that held the means of sensing and correcting temperature change quickly and accurately, without bulk, without clumsy linkages or moving parts.

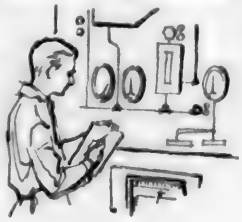
New facts came to light when these controls were actually put to use. They not only proved to be faster, simpler, easier to maintain. They also were able to do a complete comfort control job in ways ordinary controls couldn't begin to match. And they saved money.

You can now assure a client that where applicable, electronic controls will deliver maximum comfort with maximum convenience, efficiency, and economy.

What are advantages?

What is there about electronic control that makes such benefits possible? Considering specific advantages of electronics will help provide the answer. It may also suggest solutions to some of your own control problems.

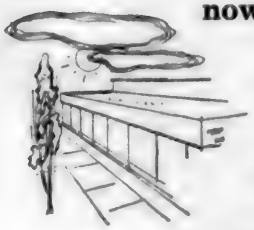
Central Control heads the list of these advantages. The electronic central control panel, set up anywhere within the building, provides a compact supervisory control center from which every vital function of the control installation is directed. Gone is the need for individual thermostat checking and calibration; all adjustments may be made *at the panel.*



comes of age

What this means in terms of savings in manpower and maintenance is obvious. What's more, the panel also eliminates that flaw in many a control system, thermostat tampering by untrained personnel. The central electronic control panel is most at home, of course, in large buildings. But the simplicity of electronics now makes the panel economically feasible even for small structures.

Automatic sequencing now 100% practical

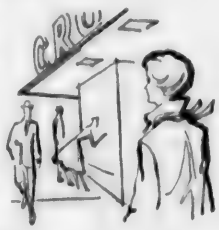


Any air conditioning control system benefits tremendously from automatic change-over from heating to cooling, and from automatic use of outside air to carry part of the cooling load. Now, electronics makes automatic sequencing practical for any job, large or small. It's convenient: the *same* thermostat may sequence from heating to full ventilation to mechanical cooling. It's effective: it utilizes the thermostat's full operating range. It's economical: automatic ventilation economizer cycle, built in, cuts cooling costs impressively; night set-back saves fuel.

With electronics, use of *averaging* thermostats—while no substitute for adequate zoning—is no longer costly and complicated. In controlling an open area as a single zone, for example, it's simple to locate inexpensive electronic thermostats so that load changes peculiar to the enclosure's equipment or occupancy are sensed and averaged out, maintaining a constant comfort level.

Ideal compensation achieved

Electronic controls are essential to the kind of compensation that means *consistent* comfort levels in any building. Shifts in occupancy; variations of wind, sun and cloud effects; sudden changes in outdoor temperature—all are compensated for with greater speed, accuracy and stability through electronics. Automatic winter-summer reset, utilizing an outdoor thermostat, cures temperature drift in winter, air-cooling shock in summer. Which means that comfort conditions inside never change with the weather.



Simplicity is inherent in electronic controls; no specialist is needed for installing or servicing. Wiring is low voltage, with standard color coding—easily understood by any heating and air conditioning technician. Today's installations will be up-to-date for many years to come. Maintenance and equipment aging problems are minimized, because the electronic thermostat contains no moving parts.

Key word: flexibility

These advantages are summed up in one word: *flexibility*. It means that all or any combination of the electronic system's features are readily adaptable to the solution of specialized control problems. The result is better, more efficient, more convenient control, and with important dollar savings.

In fact, it's *flexibility*—in the entire field of temperature control — that helps establish clearly Honeywell's leadership. For only Honeywell makes *all three types* of control systems: pneumatic, electric, electronic, each with distinctive advantages for certain applications. Thus only Honeywell is able, with complete objectivity, to help you select the one system shaped perfectly to the needs of the building and its occupants.

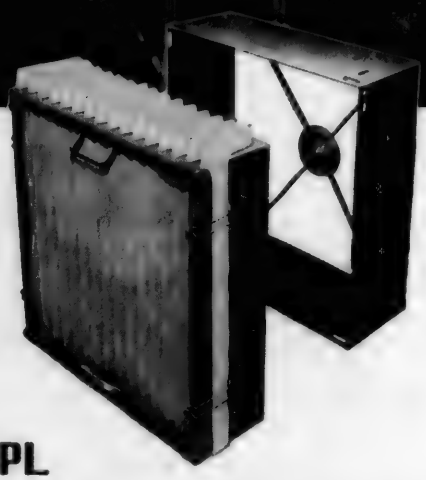
• • •

Ask for our new electronic control booklet which tells more fully how to apply electronics to your control problems. Write Honeywell Dept. HV-12-149, Minneapolis 8, Minn.

Minneapolis-Honeywell Regulator Company

Super-clean air with

PRIMARY | **SECONDARY**



AAF

Roll-O-MATIC

Electro · PL

While collecting all but the minute particles of dust and smoke, ROLL-O-MATIC carries out its own maintenance program. Filter curtain, consisting of a 5 ft. wide by 70 ft. long "blanket" of bonded glass fibers, compressed into a roll 13" in diameter, is mounted at top of unit. Controlled by an automatic timer, the curtain moves down face of filter to maintain desired operating resistance and the dirt-laden media re-rolled on spool at bottom. Rolls are changed like the film in a camera.

A perfect trap for the tiny particles of smoke and dust remaining in the airstream! The Electro-PL is a dry type electronic filter combining high efficiency with simplified design. Its Airmat paper media is low in cost and after accumulating a full dust load is easily replaced with clean media which returns filter to its original efficiency.

The combination AAF air filter installation pictured above is part of air conditioning system serving the American National Bank, Chicago, Ill. System was installed by Kroeschell Engineering, Chicago, Ill.

minimum care

BETTER AIR IS OUR BUSINESS!

Self-Servicing Roll-O-Matic Teams With Electro-PL Filter to Form Highly Efficient "Care-Free" Air Cleaning Operation

Here are two filters that "pool" their basic features to bring you performance and maintenance advantages not found in any single air filter type. This versatile combination was created for those operations demanding super-clean air but whose location in areas of heavy dust concentrations posed a constant and costly filter maintenance problem.

CLEANING EFFICIENCY— HEAVY DUST TO ELUSIVE SMOKE

ROLL-O-MATIC, serving as the primary cleaner, collects the heavy portion of the dust load—removes all but the minute particles of dirt and smoke.

"Clean-up position" falls to the Electro-PL. This electronic filter completes the job—collecting the small particles of dust and smoke that so frequently cause product contamination as well as smudging and discoloration of interior surfaces.

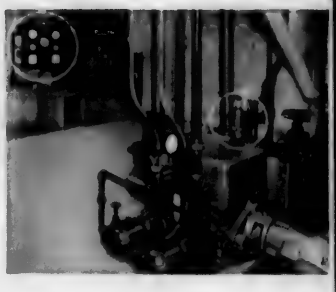
MAINTENANCE—SELDOM AND SIMPLE

The primary cleaner usually poses a maintenance problem due to the nature of the dust load collected. But not the ROLL-O-MATIC! Its renewable media filter curtain assures highest cleaning efficiency automatically for weeks and months on end—with maintenance reduced to once-a-year replacement of the Roll-O-Mat media.

Light nature of the Electro-PL's dust load makes for infrequent maintenance which consists of simple replacement of the Airmat paper media.

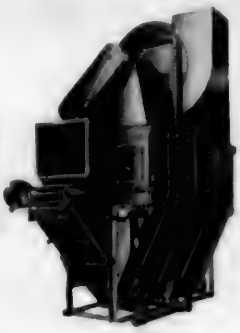
Whether it takes one or a combination of filter types to solve your problems, AAF has both the experience and line of product to meet your needs in the most effective and economical manner. A call to your nearby AAF representative will put all the resources of "Air Cleaning Headquarters" at your disposal.

Illinois Selectotherm — an automatically controlled high vacuum steam heating system which, through single dial control, balances heat supply against heat loss to provide even, constant warmth.



herman nelson Unit Blowers — a new, diversified line of direct and belt driven centrifugal fans available in a wide range of wheel diameters and capacities.

AAF Type N ROTO-CLONE—a high efficiency hydro-static precipitator designed for the collection of both coarse particles and extreme fines in excessive concentrations. Available in exhaust volumes up to 50,000 cfm.



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I would appreciate receiving catalogs describing the following equipment—

- ☐ ROLL-O-MATIC Air Filters
- ☐ Electro-PL Air Filters
- ☐ Illinois Selectotherm
- ☐ Herman Nelson Unit Blowers
- ☐ Roto-Clone Dust Control Units

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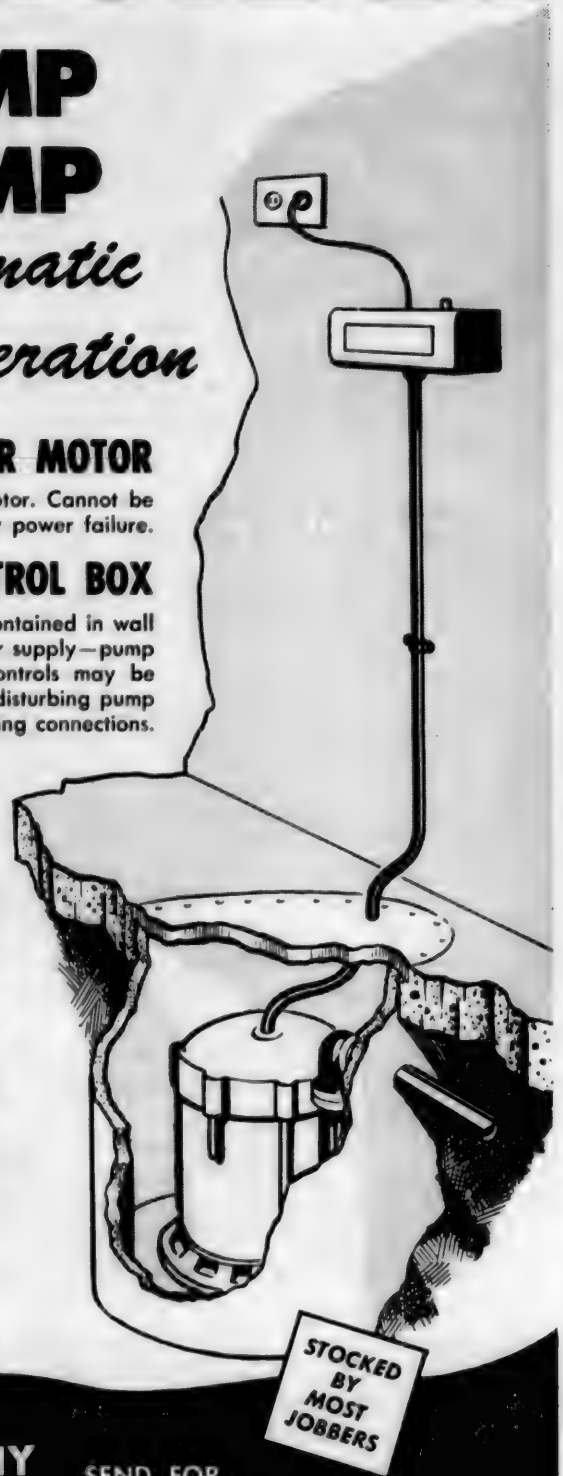
for automatic submerged operation



Designed... WITH CAPACITOR MOTOR

1/3 H.P. Hermetically sealed capacitor motor. Cannot be damaged by power failure.

WITH WALL MOUNTED CONTROL BOX

All relays and overload protection contained in wall mounted control box. PLUGS into power supply—pump power cable PLUGS into control box. Controls may be serviced or replaced without disturbing pump or piping connections.

WITH ELECTRODE CONTROL

Sure, positive electrode control. No moving control parts in pit. No possible damage from dirt or water, no diaphragms to replace.

FOR LONG LIFE

Cast iron housing, bronze impeller, stainless steel shaft, capacitor motor—all insure long life and trouble-free service.

FOR ECONOMICAL INSTALLATION

Operates in Metal, Tile or Concrete Sump—2 to 12 feet deep. Can be installed in a 15" opening with less than 2 ft. headroom clearance above pump. Hgt. 12¾"; dia. 11"; wgt. 50 lbs. Same pump used in sumps 2 to 12 feet deep.

PERFORMANCE

Discharge (ft.)	5	10	15	20
Cap. GPH	3600	3350	2400	1830

STOCKED BY MOST JOBBERS

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SEND FOR BULLETIN SS 800

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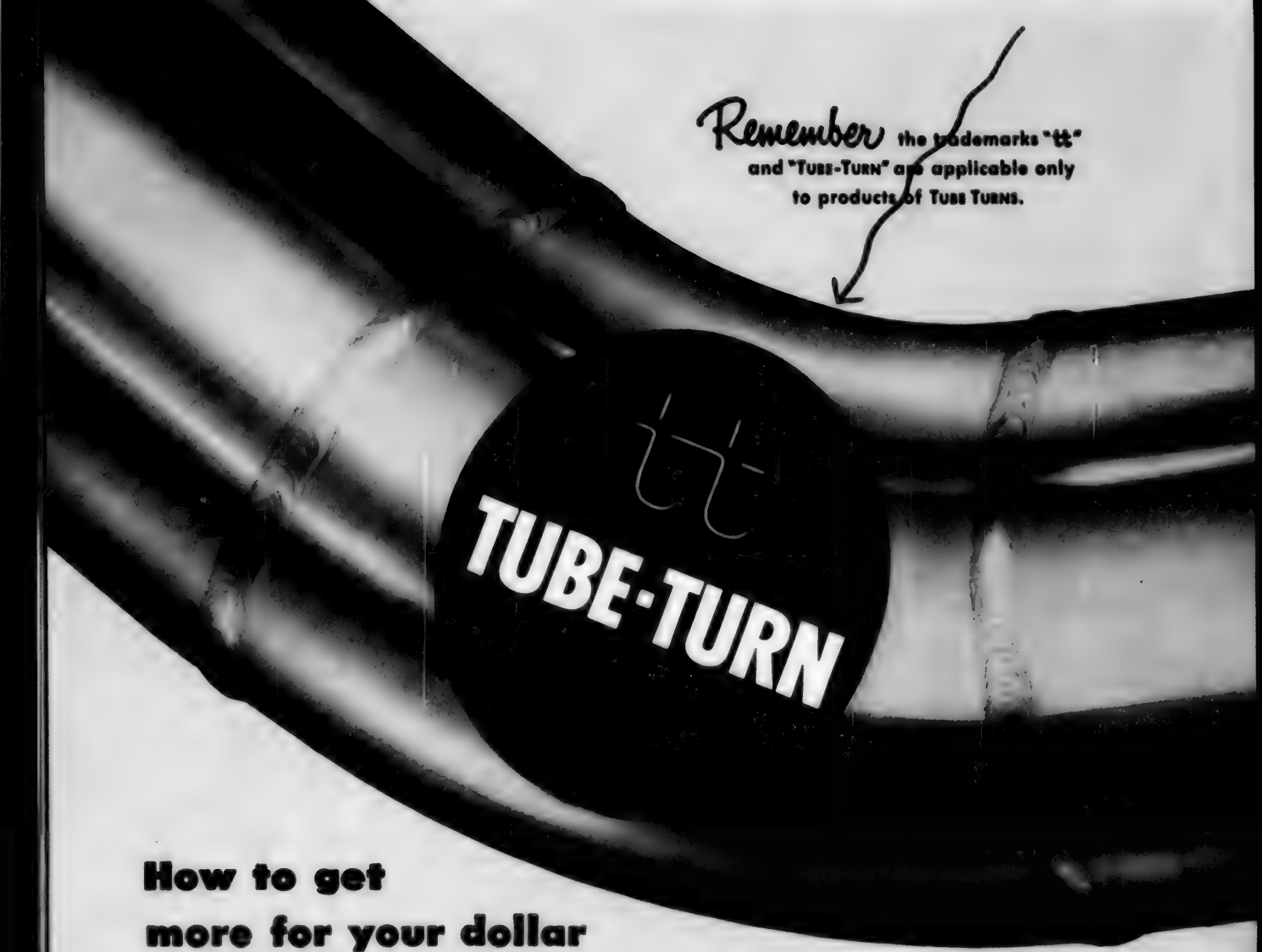

How to get more for your dollar in stainless steel fittings!

When you specify TUBE-TURN* Welding Fittings and Flanges . . . regardless of type, size or material . . . you can be *sure* you are getting *top value.* Manufacturing improvements which we are constantly making assure not only unsurpassed quality, but economies which are passed on to you.

In TUBE-TURN Stainless Steel Welding Fittings, for example:

Recent advancements in our production techniques have netted important savings, resulting in price reductions. Are you taking advantage of these savings . . . plus the extra values described on the next page?

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet *all* U.S. piping code specifications.

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Kansas City • Denver
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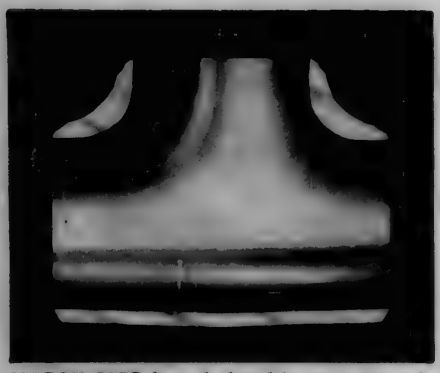
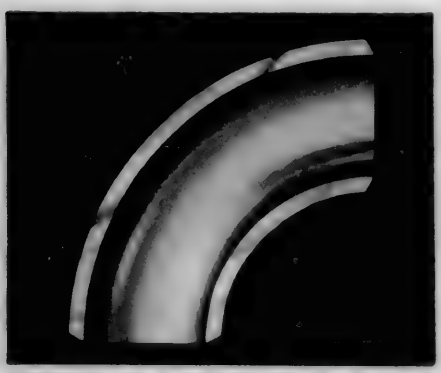


MATCH PIPE for calculated bursting strength.

LONG-LASTING IDENTIFICATION. Lectro-etch markings give complete, permanent information. Fittings have bright, attractive finish.

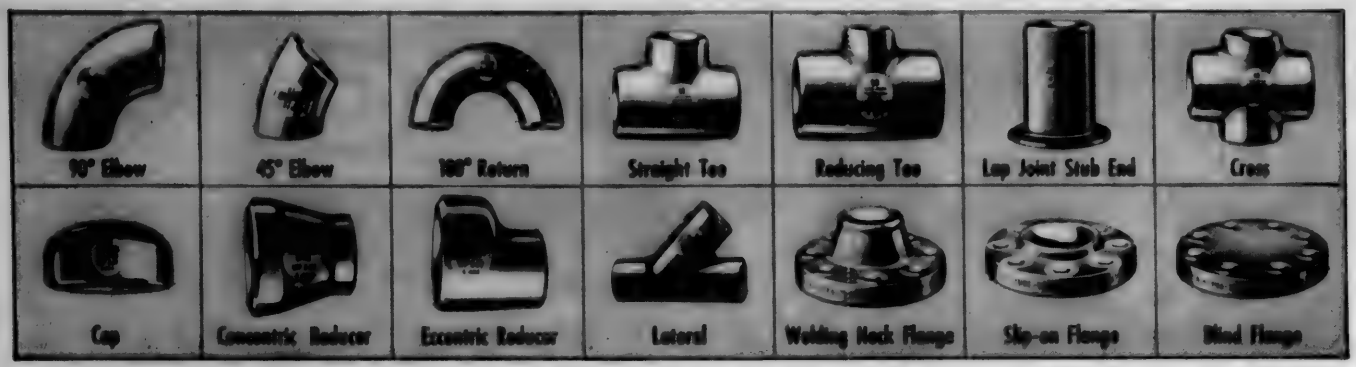


UNIFORM WALL THICKNESS. Pipe minimum wall thickness tolerance of 87½% of nominal thickness is maintained.

TUBE-TURN*

Stainless Steel Welding Fittings and Flanges offer you these extra values

MEET ALL CODES: ASTM A312 (for material); MSS SP43 and ASA B16.9 (for dimensions); MSS SP25 (marking procedure).



COMPLETE LINE IN STOCK . . . four analyses: Type 304, 304L, 347 and 316. Four wall thicknesses: Schedules 5S, 10S, 40S, 80S.

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224 East Broadway, Louisville 1, Kentucky
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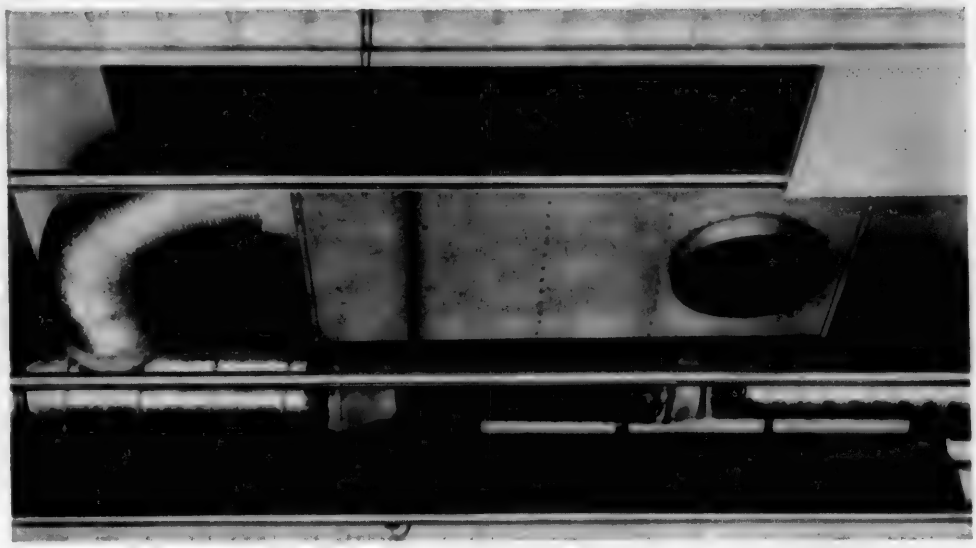
*"TUBE-TURN" and "TT" Reg. U. S. Pat. Off.

TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

UNION CENTRAL Annex Building, Cincinnati, utilizes some 200 Kno-Draft High Pressure Air Diffusers for quiet, draftless, comfortable air distribution.



BEHIND THE SCENES photo shows typically compact Kno-Draft single-duct system. Note flexible connectors. Outlets at same level as ducts explain why...

High Pressure Saves Space

Space saving, of course, is only one advantage of high pressure air transmission. But it's important. High building costs make it worth while to reduce space allotted to air ducts; and in existing structures, small high pressure ducts have permitted central system air conditioning where space limitations prohibited conventional designs.

Additional advantages of Kno-Draft high pressure systems are: (1) flexibility to meet changes in air conditioning requirements without modifying the system, and (2) individual room temperature control from central station systems.

Kno-Draft High Pressure Air Diffusers are especially designed to handle air at branch duct velocities up to 3,000 feet per minute. Outlets are equipped with dampers and sound traps to eliminate noise. System provides even temperatures throughout the area *without drafts.*

For a full description of Kno-Draft High Pressure Air Diffusers and layouts for typical systems, read the Connor textbook on the subject. Write on your letterhead for a copy of Bulletin K33. Connor Engineering Corporation, Dept. J-125, Danbury, Connecticut.

CONNOR

kno·draft®

adjustable air diffusers

NEW AND IMPROVED AIR FILTERING...

Glasfloss DISPOSABLE AIR FILTERS

The new, extremely fine, silky fibers in Pittsburgh's improved Glasfloss Filters stop and hold more dust—and are easy on the hands!

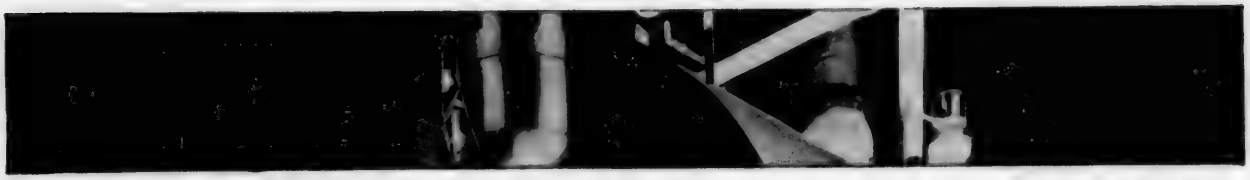
Available in all standard furnace and air conditioning filter sizes, Glasfloss filter media is also available in Bulk Roll-Paks to provide convenient and economical replacement material for all commercial and industrial filtering uses.

For complete information and prices, write Glasfloss Dept., Fiber Glass Division, The Pittsburgh Plate Glass Company, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER GLASS

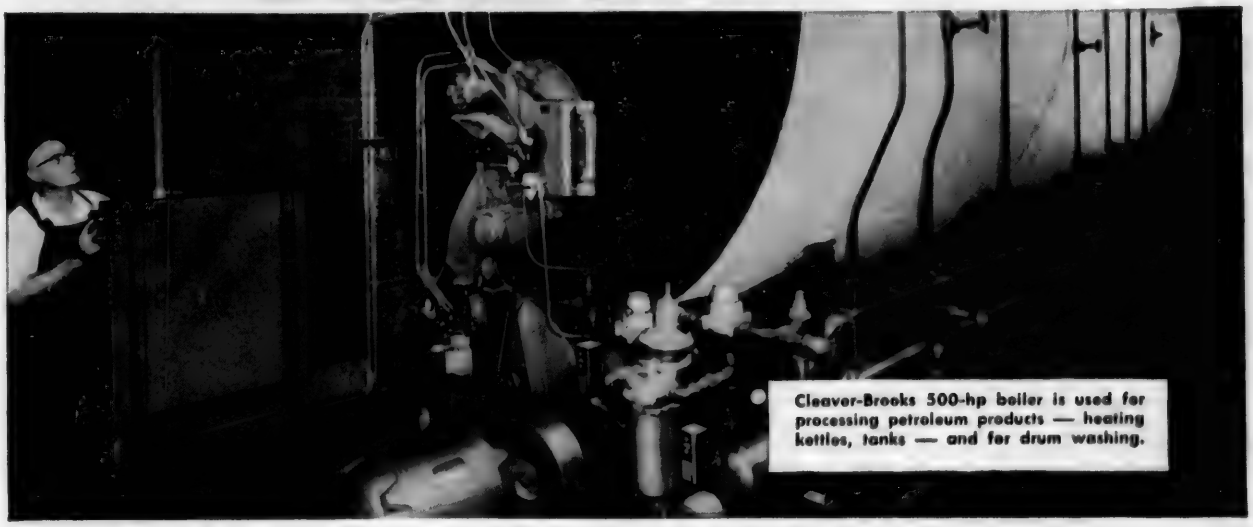
PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY



"We heard Cleaver-Brooks Boilers were OK"

. . . and what an understatement that proved to be for a Milwaukee petroleum marketer*



Cleaver-Brooks 500-hp boiler is used for processing petroleum products — heating kettles, tanks — and for drum washing.

Look at the record:

350 gallons of fuel oil saved per day!

On an annual basis — that's more than 90,000 gallons of oil saved.

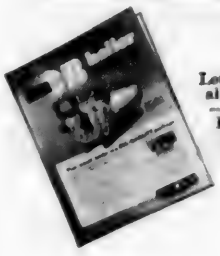
Complete shutdown flexibility with the assurance of fast steaming from a cold start is the key to these remarkable savings for a petroleum processor and marketer in Milwaukee, Wisconsin. Now, a Cleaver-Brooks 500-hp boiler operates 10 hours a day, 5 days a week, where formerly two 150-hp units operated continuously 24 hours a day, 7 days a week. Fewer boiler working hours also saves up to $11,000 yearly in maintenance.

By replacing outmoded equipment, this petroleum processor also enjoys the benefits of guaranteed 80% operating efficiency, four-pass design, forced draft, 5 sq. ft. of heating surface per boiler-hp and fully-automatic firing. Cleaver-Brooks Company, Dept. P, 315 E. Keefe Ave., Milwaukee 12, Wisconsin — Cable Address: CLEBRO — Milwaukee — all codes.

*Name supplied upon request.

Look at these "before-and-after" facts

NEW (1) 500-hp Cleaver-Brooks boiler	OLD (2) 150-hp obsolete boilers
FUEL CONSUMPTION	
480 gal. per day (10-hr. day) 46 gal. per hour (operating hour)	800 gal. per day (24-hr. day) 60 gal. per hour (operating hour)
SCHEDULED STEAM SERVICE	
Automatic firing from 6:30 a.m. to 4:30 p.m. Fast steaming from a cold start.	Continuous 24-hr. operation. Couldn't shut down. Wasted heat. No benefit from extra hours of operation.
OVERALL EFFICIENCY	
Average 125 lb. of steam per gal. of oil.	Average 96 lb. of steam per gal. of oil.
OVERALL MAINTENANCE	
Cleaned every 6 months. Single maintenance foreman.	Cleaned every 6 weeks. Required extra fireman for weekends.



Let us help you beat the penalties of boiler obsolescence — with a modern Cleaver-Brooks installation. Sizes from 15 to 600 hp, 15 to 250 psi — steam or hot water, for heating or processing. Write for catalog.

Cleaver Brooks 25th YEAR

TWENTY-FIVE YEARS OF LEADERSHIP BY THE ORIGINATORS OF THE SELF-CONTAINED BOILER

Keeping Tubes **COOL** *is a job for quiet operating*

Gallaher Air-Vans®

WXIX, Milwaukee represents a $1,500,000 investment by the CBS television network

Lofte and Fredericksen, Engineers

IT takes cool tubes to keep a TV station on the air. And at WXIX, the Columbia Broadcasting System outlet in Milwaukee, Wisconsin, Gallaher Air-Vans do this vital job.

Air-Vans are teamed with the station's air conditioning system to keep the hundreds of electronic tubes necessary for program transmission from burning up. The exhausters literally help keep banks of tubes from melting in self created heat.

Without an efficient power ventilating system these banks of tubes would melt.

Air-Vans are used in other areas of the station for the everyday tasks of ventilating toilet rooms, equipment rooms and studios.

Quiet operation and accurate performance are the reasons given by the engineering firm of Lofte and Fredericksen for specifying Gallaher.

"We have used them extensively and we have confidence in their performance," commented Bert Fredericksen.

The WXIX installation is another example of how more and more architects and engineers are turning to Gallaher Air-Vans.

It pays because when you buy Gallaher you can be sure of performance, and with Gallaher performance comes low noise levels, low installed silhouette, patented scroll design and protective air-seal-off, availability in special metals and weatherproof design. Capacities 150-65,000 CFM Static Pressures to 4 inches. These features make Air-Vans ideal for almost any industrial application.

Pioneers in Research-designed power roof exhausters.

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at the POINT OF USE

cuts costs for process industries

To provide high quality process steam for widely separated operations, many processing plants are installing completely packaged Superior Steam Generators at, or close to the point where steam is used. These highly efficient and compact units may be set up on any floor capable of supporting their weight, connected to service supply and fuel lines, and put into operation within 24 hours of delivery.

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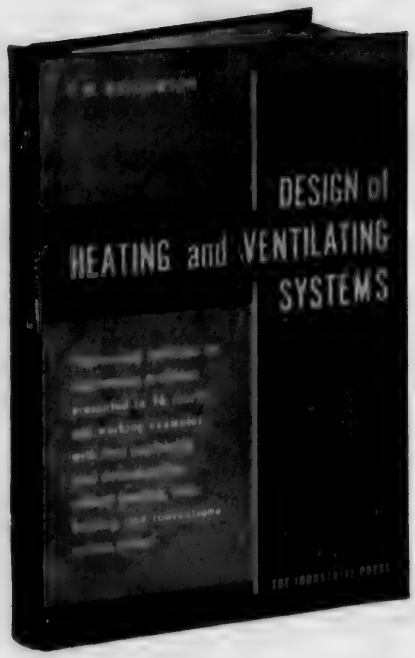
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

A New Book to Help You Solve Heating and Ventilating Design Problems



If you are concerned with problems in the design of heating and ventilating systems, here is a book that will save you hours of time and, in addition, insure accurate calculations for many complex calculations.

You can solve problems involving load determination, duct design, panel heating, solar heating and combustion analysis *directly* by means of the 96 full-page working graphs which are an outstanding feature of the book. In many cases the use of these graphs will entirely eliminate calculation, while in others the graphs serve to minimize the arithmetical work needed in solving the equations. The scales used in constructing the graphs have been selected so that *the accuracy to which each graph can be read will equal or exceed the limits of accuracy of the equation from which it was derived.*

Opposite each graph is a design example and the solution illustrating the use of the method.

Explanatory text in each chapter clearly explains the engineering background and the mathematical basis of each graphical solution. Basic handbook data are also included so that, with the simple insertion of field data, design situations can be analyzed. Another important feature of the book is the inclusion of complete data for systems designed to utilize partial solar heating through the use of large picture windows. This is the first text on heating to include engineering data on this increasingly important subject.

The author is Professor of Mechanical Engineering at the University of California. He is the author of "Industrial Heat Transfer" and co-author of a number of books on panel heating, refrigeration and air conditioning. His knowledge of the field is well grounded on practical experiences as well as theory, as he acts as consultant for many industrial firms.

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But it takes more than a sign to stop low water . . .

. . . and the hazards that can accompany a low water condition in both a steam and hot water heating boiler.

We are all agreed that our schools must be made as safe as possible. With schools so crowded today and facilities overtaxed, there is greater need for vigilance than ever before.

One thing you can do is to see that the boiler water line is under the endless vigil of McDonnell boiler water level controls. Low water can strike anywhere, for any of a score or more reasons, bringing with it the threat of serious and costly damage. And make no mistake about this: Low water is just as much of a possibility in hot water boilers as in steam boilers.

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No. 51-2, the Boiler Water Feeder and Low Water Cut-off combination that fits most school jobs. For steam and hot water space heating boilers. Other combinations to fit all boilers.

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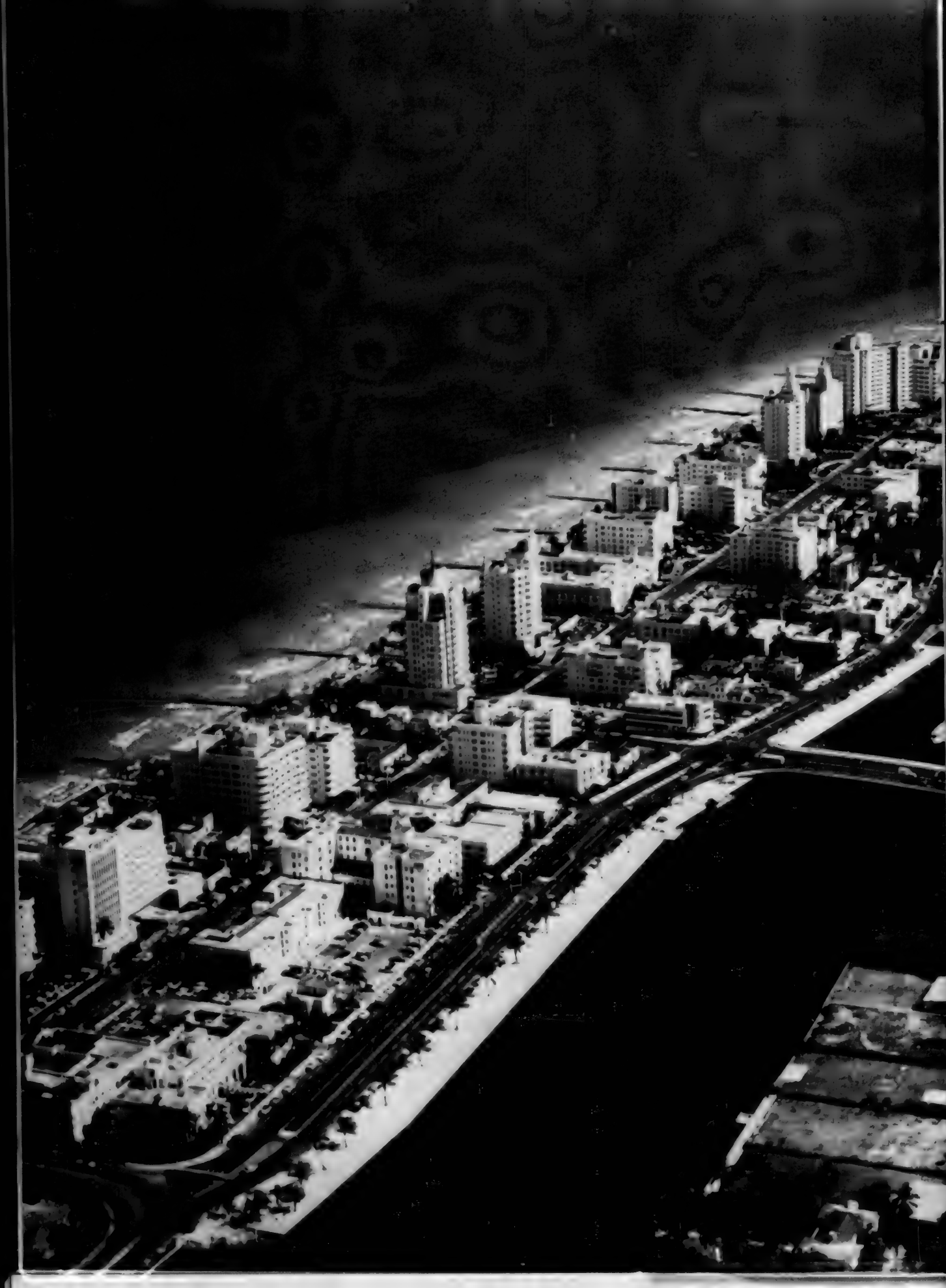

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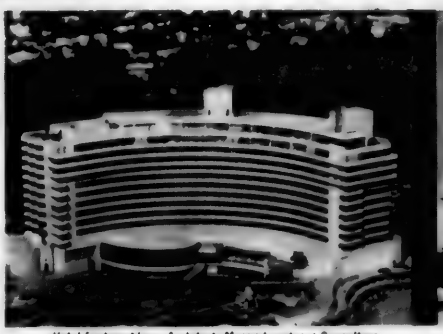

Hotel Fontainebleau Architect: Morris Lapidus / Consulting Engineer: Bruce Jacobs / Ventilating Contractor: Hill-York Corporation

Bal Harbor Hotel. Architect: R. E. Collins / Consulting Engineer: E. A. Hosser, Jr. / Contractor: C. R. Clark Co

Balmoral Hotel Architect: Carlos B. Schoeppl / Consulting Engineer: Sennett Engineering Co. / Ventilating Contractor, Industries, Inc

(Left) Low contour Roof Exhausters, blend with architectural design, (center) Wall Exhausters, architecturally sculptured button design; (right) Belt Drive Centrifugal Roof Exhausters, capacity up to 13,000 CFM.

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The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

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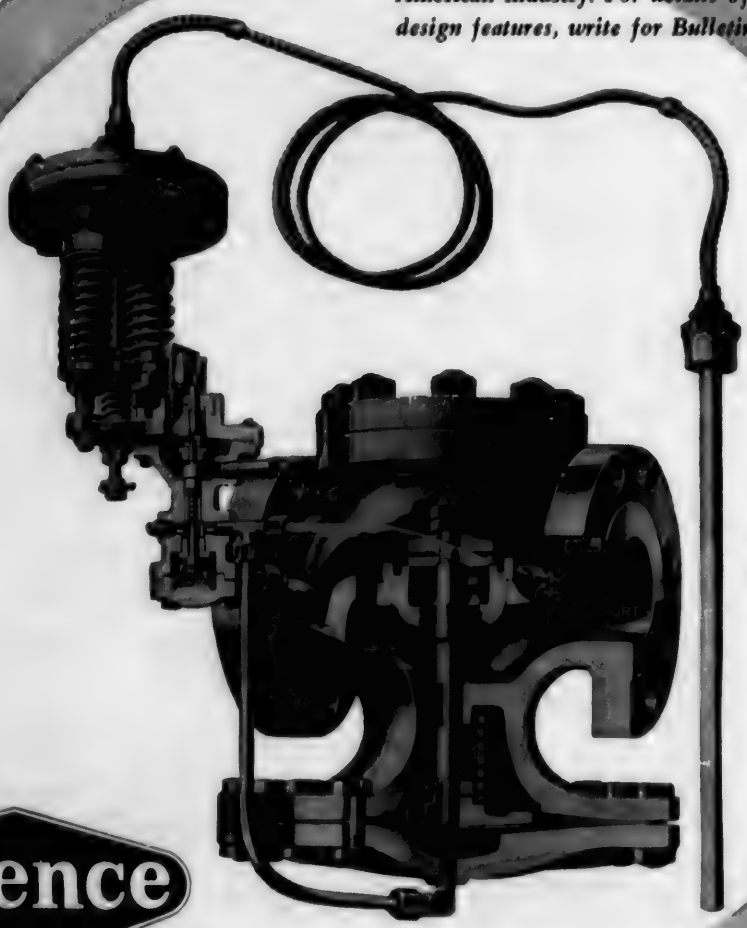
This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



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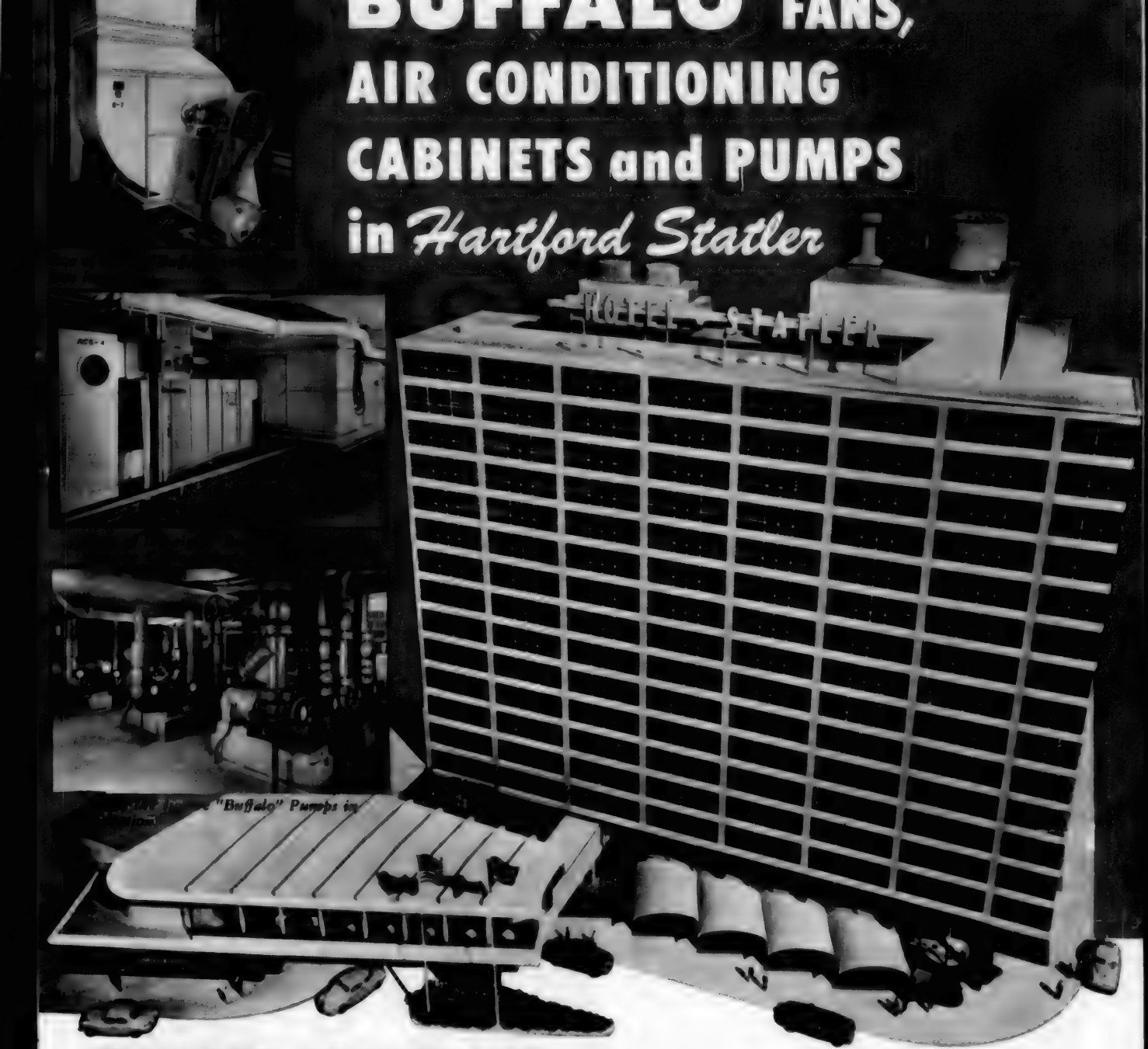

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...and 20 GENERAL Converters easily supply it for all 1684 apartments

Comfortable suburban living is the theme at beautiful new Arlington Towers Apartments. And an important part of the "comfort picture" is the heating of 869 efficiency apartments, 755 one-bedroom apartments, and 60 penthouses. GENERAL Converters do the job nicely. A compact bank of converters in each of the project's four spacious buildings provides high efficiency heat transfer from the steam lines to the circulating hot water system. There's always plenty of heat for each apartment.

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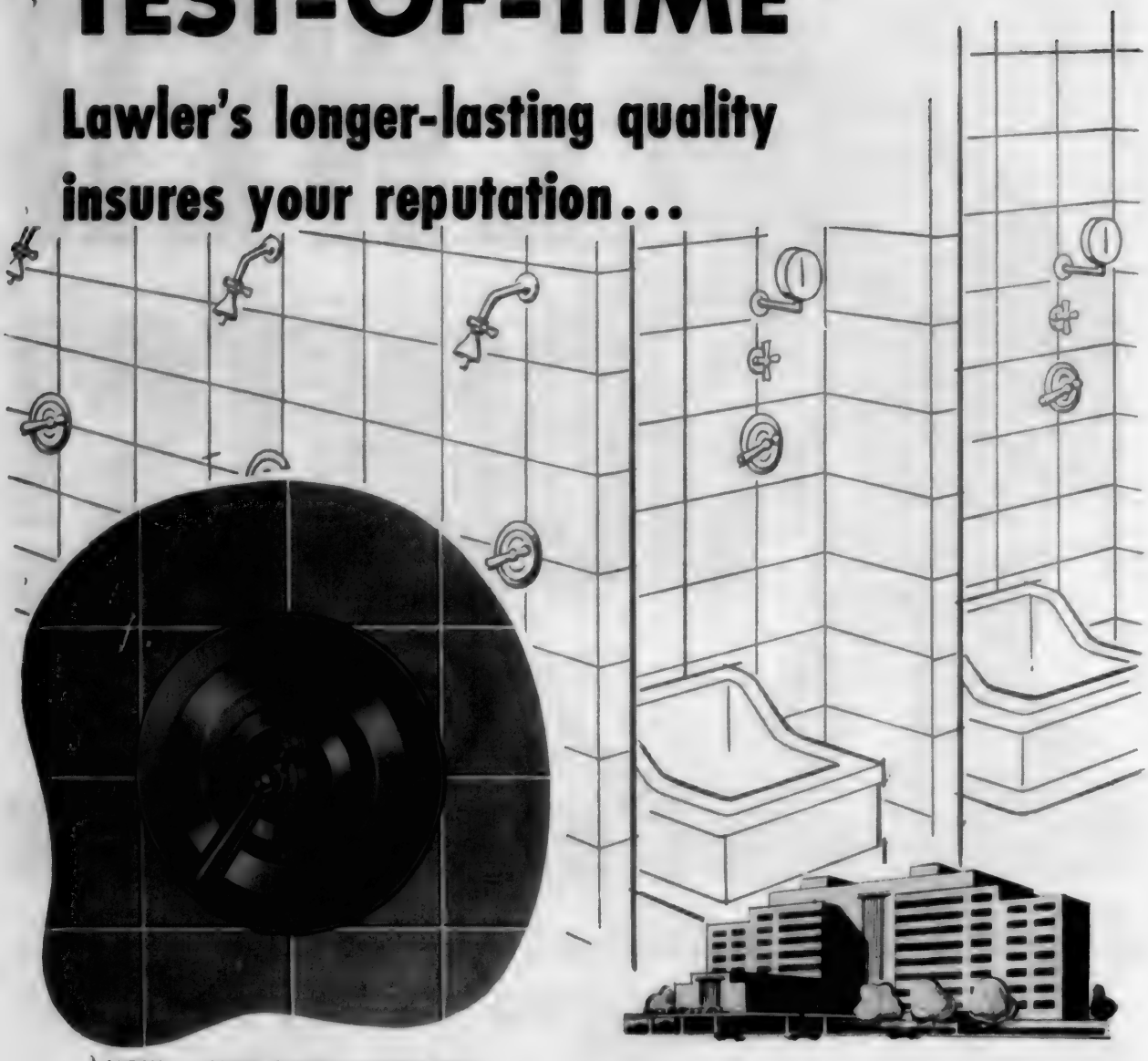

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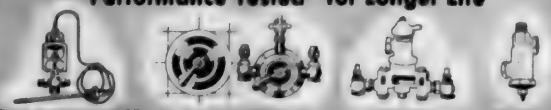

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Interior zone conditioning of waiting rooms, corridors, etc. is accomplished by 4 Bush Air Handling Units . . . 2 of the vertical floor-mounted type and 2 horizontal ceiling-hung models. These versatile units are available in a wide range of capacities and with extra-efficiency Inner-Fin coils — exclusive with BUSH.

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—Payroll Savers hold their Bonds: From May 1, 1951, to September 30, 1955, approximately $18.7 billion E Bonds reached 10-year maturity dates. On September 30, 1955, approximately 70.3% of the matured bonds were retained by their owners under the automatic extension plan. With additional interest earned since maturity dates ($560 million), cash value of the matured bonds held by individuals amounts to approximately $13.7 billion.

—on September 30, 1955, the cash value of Series E and H Bonds—the kind sold only to individuals—totaled 39.7 billion dollars, a new high.

To the Payroll Saver, and to the man who buys his Bonds at a bank (because his company does not provide the Payroll Savings Plan) a One Hundred Dollar Savings Bond looks bigger and better and *is* bigger and better, than a check for $75. *Make this a merrier Christmas for every employee. Give the gift that keeps on giving.*

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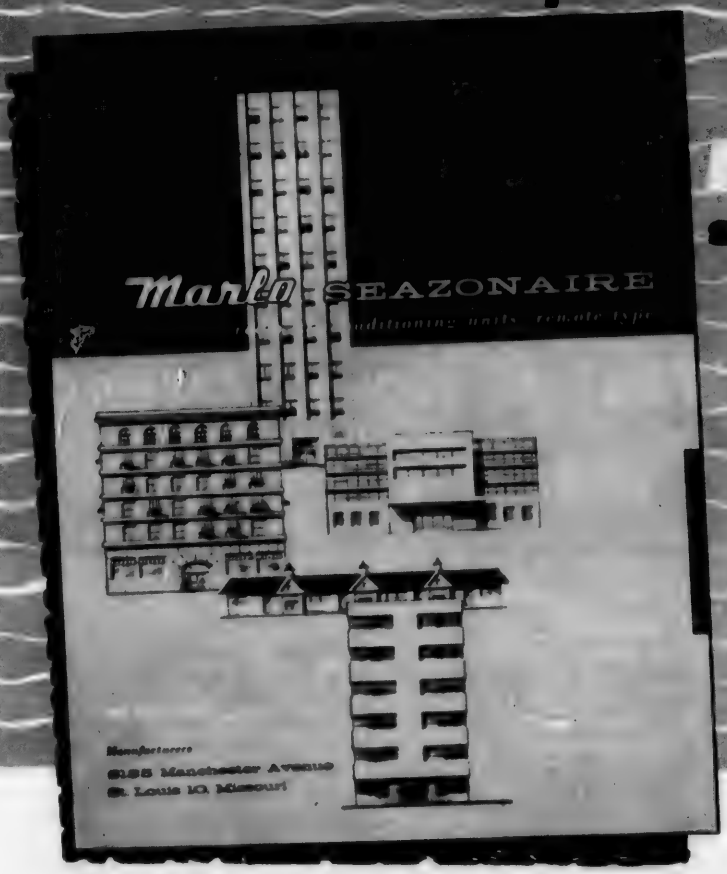

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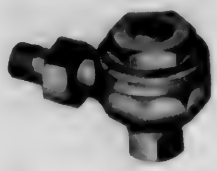
What a big difference a trap can make!



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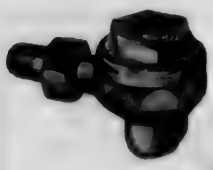

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Marsh Packless Radiator Valves are perfect team mates for Marsh Radiator Traps. The metal-to-metal seal places them in a class all their own.

Yes, the success or failure of a steam distribution system can hinge on things as small as radiator traps. That's why it pays to use Marsh Radiator Traps—traps that are individually and permanently adjusted to close tight on steam, but open promptly and pass air or condensate at temperatures only a few degrees below closing temperature.

The part that provides positive operation in Marsh Radiator Traps is that rugged-but-sensitive thermostatic diaphragm. After this element has been assembled it is made completely seamless by a heavy overall deposit of copper. It is then filled with an accurately measured charge of volatile fluid; finally tested by expert operators to make sure that its expansion and contraction is exactly right to produce the utmost efficiency and economy.

Construction throughout is in keeping with the effective diaphragm. Bodies are of extra heavy cast brass suitable for pressures up to 125 lbs. steam. Bonnet assemblies of a given type and size are interchangeable. Trap seats are renewable. All components are made with a large safety factor beyond rated operating pressures.

Next time make it Marsh throughout and see the difference . . . Marsh traps, packless valves, bucket traps, venting valves. All are covered in the new fact-filled catalog.

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Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta

MARSH

Heating Specialties SINCE 1865

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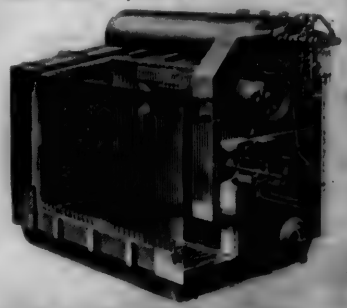
Another Watchdog for 165 Million A

Soon to rise out of the sea, this "Texas Tower" will stand on the continental shelf along the Atlantic coast. One of a number of unique radar platforms planned to strengthen national defense in the Air Defense Command's mission of defending the United States against possible enemy air attack, it will be installed in relatively deep waters. The platform, housing billets, mess facilities, equipment and s... area will be well above the highest waves expected at the site. ... the weather deck will be available as a helicopter landing ...

Out in the open sea, an installation of this importance must ... steam generators that are completely reliable and efficient. The ... that two oil-fired B&W Boilers, Type FM have been selected to serve this unusual installation, is a tribute to their established reputation for dependable service. Having a 10,000 lb per hr total steam capacity, these units are equipped with electrical controls and safety features, are completely automatic, and require very little supervision. Operated alternately, each FM will individually carry the full steam load for heat, hot water, laundry, and cooking requirements.

In going to sea for this special job, B&W FM Boilers join all the B&W Marine Boilers supplying steam for both commercial and naval vessels. With a record of dependable and economical service to industries, utilities, institutions, and other users, FMs are now serving in virtually every category requiring steam. An indication of their widespread application is their total steam capacity, in service or on order, of more than 11,000,000 lb of steam per hr. More than half of this capacity is in space-saving multiple-unit installations.

Compact, versatile, the shop-assembled FM ... is available in standard sizes for steam loads ... ranging between 2900 and 40,000 lb per hr ... at pressures to 235 psi—is widely used for ... higher pressures and with moderate super-heat. Whether your requirements are unusual ... or conventional, we'll be pleased to show you ... how the FM Boiler can help reduce the ... of your steam. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd ... New York 17, N. Y.



FM BOILER SIMILAR TO THOSE INSTALLED IN THE RADAR PLATFORMS

BABCOCK & WILCOX

BOILER DIVISION

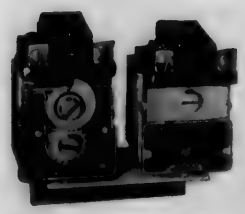
Interior view of the Meico packaged air conditioner showing Allen-Bradley control.

A-B Special Control Panel
Allen-Bradley air-conditioning controls cover a line of temperature and pressure switches for all operating requirements.
Bulletin 837 temperature control
Bulletin 849 automatic timer. Adjustable 1/6 sec. to 3 min.
Bulletin 836 pressure switch—available in various forms

Exterior view of the Meico air conditioner made by Melchior, Armstrong, Dessau Co.

QUALITY CONTROLS

for Air Conditioning and Refrigeration



Bulletin 836 high and low pressure cutout. Range—30 in. vacuum to 700 psi.

Bulletin 709 Form 3 solenoid starter with HAND-OFF-AUTOMATIC selector.

Allen-Bradley automatic controls are so popular for air-conditioning and refrigeration service because—

1—Allen-Bradley solenoid starters have only ONE MOVING PART—there are no pins, pivots, levers, or bearings to corrode and stick. Hence, these starters are trouble free.

2—The double break, silver alloy contacts need no maintenance attention. This time and money-saving feature is a "plus value." Just install them . . . and forget them.

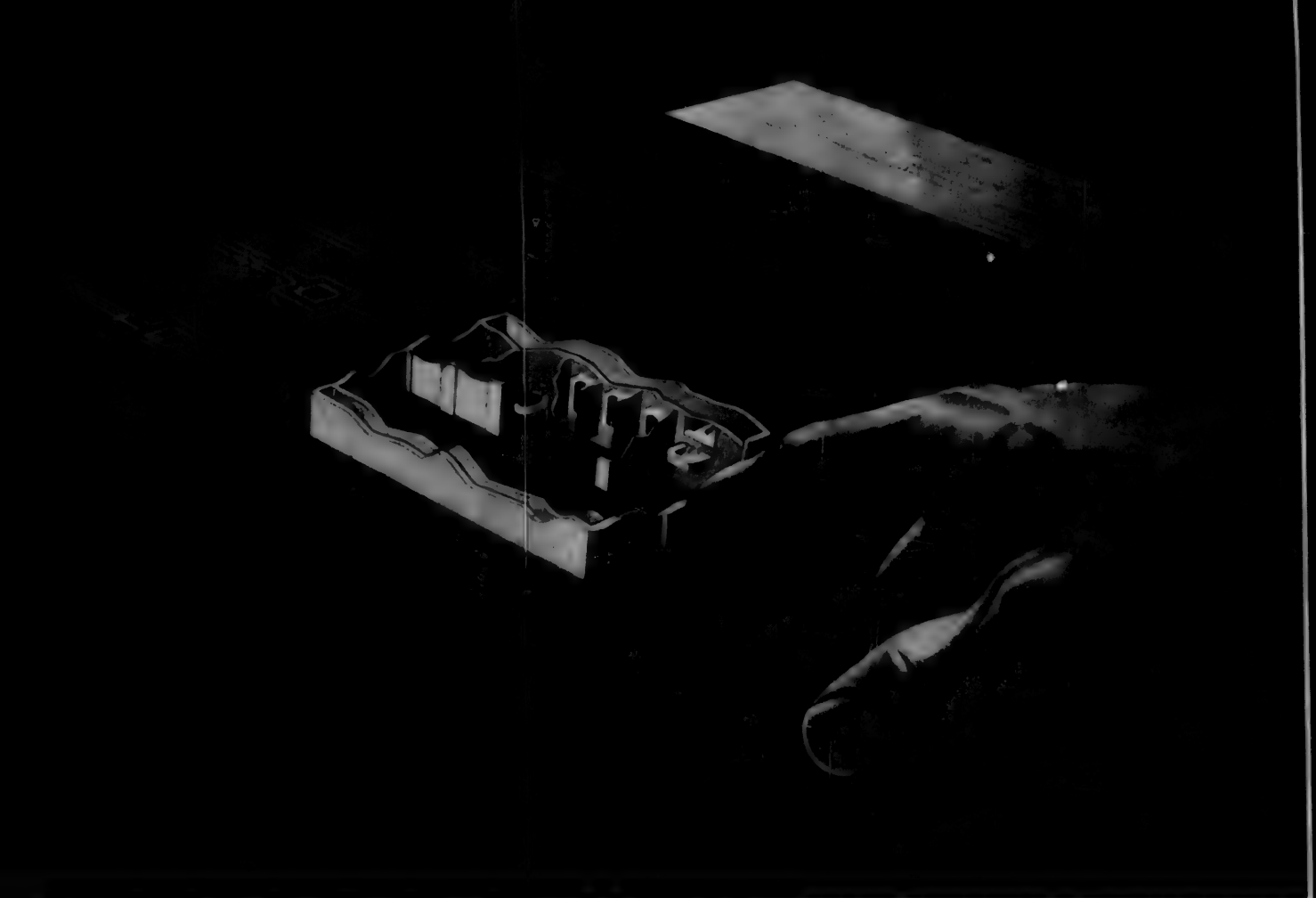
3—The thermal overload relays remain accurate and dependable, even after years of service.

Standardize on Allen-Bradley controls . . . you and your servicemen will be money ahead.

Allen-Bradley Co., 1330 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY



but what about the rooms that everybody sees?

Board rooms and presidential suites get a lot of attention in the plans . . . but the thoughtful architect knows that they do little in forming tenant and public opinion of his buildings. Only a handful of people ever see them.

The places that EVERYBODY sees are the rest rooms. They are usually the *only* areas where the architect can dictate final appearance down to the last detail. Attention devoted to making the rest rooms completely modern, sparkling clean, and attractive in appearance pays off in employee morale. . . in tenant approval . . . and in continuing prestige for the designer.

"Off-the-floor" fixtures are one major means of creating modern, clean, attractive rest rooms . . . and they are used in most of the nation's newest major buildings. It is significant that all such plumbing fixtures are supported by ZURN SYSTEM• wall-type fittings and carriers. The special, engineered features of the ZURN SYSTEM assure that all stresses will be carried by the fittings and none by the wall—make it simple and easy to install, align, and replace plumbing fixtures . . . and permit changes in floor or wall treatment to be made at any time. There are no regrets when ZURN SYSTEMS are selected, as over 800,000 successful installations already serving can testify.

"Off-the-floor" fixtures carried on ZURN SYSTEMS help to attain the latest and finest in wash room and rest room appearance . . . permit hospital-like standards of cleanliness and sanitation to be easily maintained . . . and play a tremendously important part in making and keeping the building "young." For more complete details on the increasingly important part modern rest room design is playing in modern building fields, ask for our new booklet "Behind Closed Doors." 110-3

J.A. ZURN MFG. CO.

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ERIE, PA., U.S.A.

The Zurn Zero Zone• is created by mounting off-the-floor plumbing fixtures on ZURN SYSTEM behind-the-wall fittings and carriers. This permits the highest degree of rest room sanitation to be attained and maintained. All major plumbing manufacturers make fixtures to fit this system.

See our catalog in Sweet's Architectural File and Industrial Construction File.

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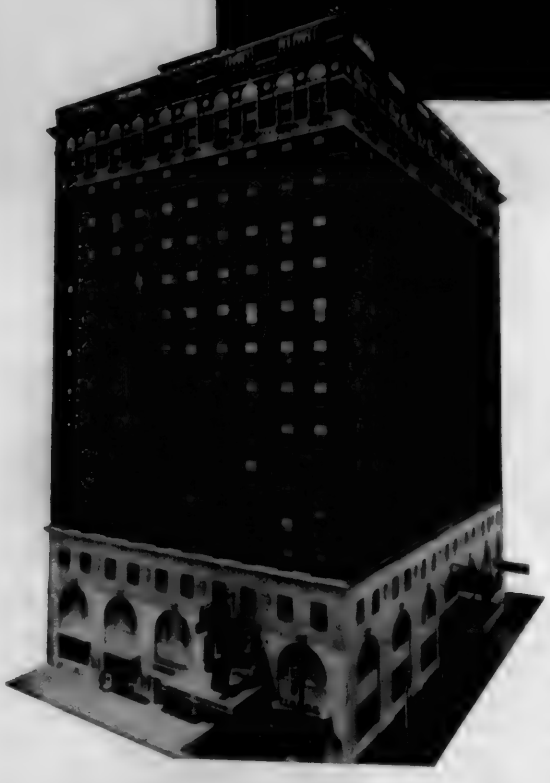

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Frick Bulletin 504 features general air conditioning; 505 shows engineering details of Frick systems; 522 describes Frick unit air conditioners. See also the Frick pages in Sweet's Catalogs.

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You can be *certain* that you're safeguarding your reputation as well as your business, when you use and recommend Reading Copper Tube—because it's made by "specialists" who make tubing and *only* tubing . . . who direct *all* their know-how toward the production of a *better* product! Even Reading's "shirtsleeve" service sets a new standard of dependability . . . because everyone—from our "top brass" on down—stands ready at all times to help you safeguard your reputation *and* your business!

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All living rooms and bedrooms in the 230 apartments of New York City's smart new Randall House, designed by Boak & Raad architects, feature Airtemp "All-in-Wall" Air Conditioners built right in.

Airtemp installs new "All-in-Wall" units in 420 rooms in new Randall house

AIRTEMP BUILDS AIR CONDITIONING TO FIT ANY REQUIREMENT! Now, for those buildings where a central air conditioning installation does not meet all of your needs . . . Airtemp has developed "All-in-Wall" air conditioning . . . A new concept in individual room cooling. Look at these exclusive "all-in-wall" features:

Quiet! Airtemp engineered for super-quiet operation—no distracting motor noise—inside or out.

Individual Room Control! Each unit can be controlled by the tenant. Automatic thermostat is standard equipment.

Flush Outside! No outside projection to mar the beauty of the building.

Full Window View! Unit is out-of-the-way *under* the window . . . extends only inches into the room.

Full Capacity! Extra-high cooling capacity is engineered by Airtemp to meet the demands of the hottest weather.

Easy Installation! Eliminates expensive on-the-spot engineering costs in new or old buildings.

Easy Maintenance! Inside access plus identical cabinet size for ½, ¾ and 1 H.P. models.

Individual Metering! Each tenant absorbs the cost.

All these services are yours when you air condition with Airtemp . . . The top engineers of Airtemp Construction Corporation—local Airtemp servicemen—plus on the spot personnel equipped to guarantee efficient operation through all the years ahead. Write Airtemp Construction Corporation, Dayton 1, Ohio, for further details.

Airtemp
DIVISION
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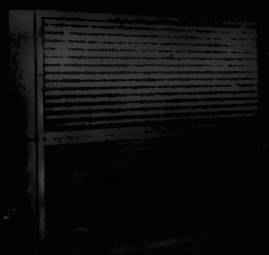
AIR CONDITIONING FOR HOMES • BUSINESS • INDUSTRY

STOP *using water!*



Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.

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Stands, hoods, and wind deflectors are available for simplified outside mounting
You need nothing else!

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True Air Conditioned Comfort with multi-vent

LOW VELOCITY AIR DIFFUSERS

SPECIFIED FOR FORD...coast to coast

Modular Multi-Vent panels will provide a quiet, concealed, draft-free air distribution system in the four new FORD buildings listed at the right.

The Multi-Vent story is simple...this system distributes conditioned air at low velocity by gentle pressure displacement. This unique feature not only eliminates all draft complaints but also allows complete freedom in locating or relocating moveable partitions without repositioning the outlet panels.

In addition Multi-Vent can handle as many as 60 air changes per hour and still maintain an even, draftless, low rate of room air motion!

These are only a few of the many reasons why Multi-Vent is the choice of the nation's leading office buildings, hospitals, laboratories, factories, hotels and restaurants.

DEARBORN, MICHIGAN

Ford Central Staff Office Building (Illustrated above)

Architects and Engineers: Skidmore, Owings & Merrill, New York

Mechanical Engineers: Jaros, Baum & Bolles, New York

Contractor: Bryant & Detwiler, Detroit

Mechanical Contractor: Thermotank, Inc., Detroit

LOUISVILLE, KENTUCKY

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JENKINS PRACTICAL PIPING LAYOUTS

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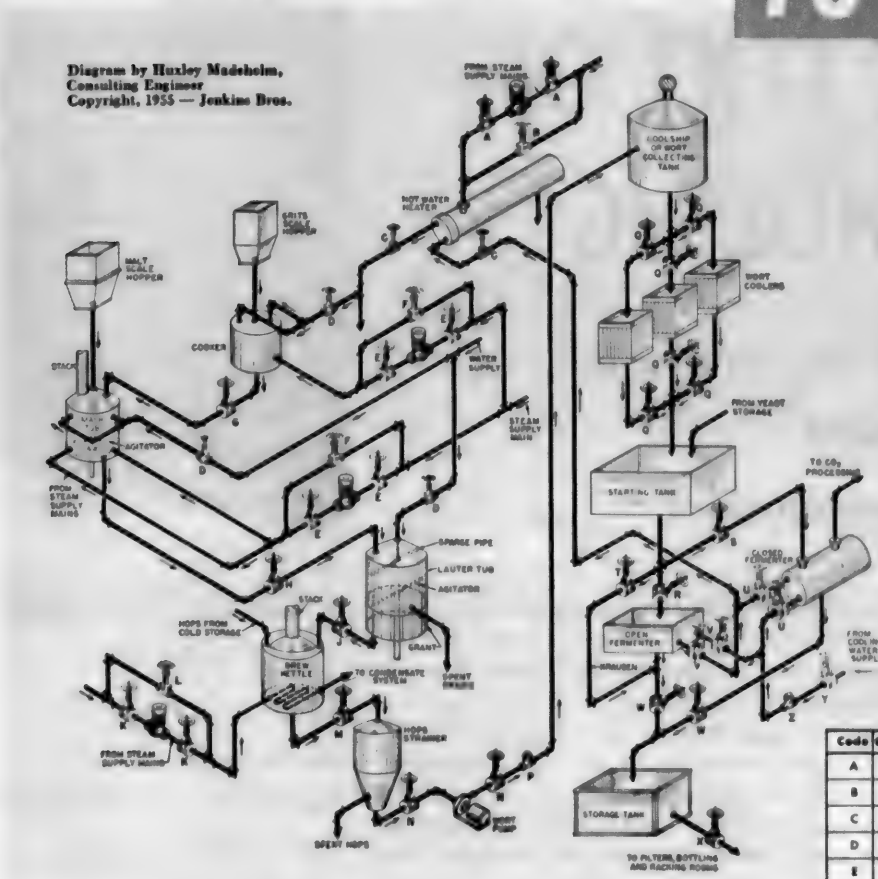

How to plan piping connections for a GRAVITY-FEED MULTIPLE-STORY BREWERY

This piping layout is typical of installations in many breweries designed for gravity-feed processing, and the principal operations are briefly outlined.

Corn grits are cooked with water in the cooker, with enough added malt to convert and liquefy the grits. When the malt, which has been mixed with water in the mash tub, is properly steeped, the finished cook is dropped into it and the resulting mash thoroughly mixed.

Pumped into the Lauter tub, the mash grains settle to form a filter bed, from the bottom of which the clear liquid containing fermentable and unfermentable sugars is drawn. Extraction is increased by "sparging" with hot-water spray. This liquid, the "wort", flows by gravity to the brew kettle.

In the brew kettle, the wort is boiled with hops to add flavor and to clarify and preserve it. The hops are then strained off, and the liquid is pumped to the "coolship" tank to settle. It then goes through coolers to reclaim most of the residual heat, and on to the starting tank.

In the starting tank, the yeast is added, and the mixture flows to the fermenters, some of which are closed to collect the carbon dioxide gas for future use. After fermentation, the beer is cooled again and sent to storage tanks for eventual bottling and racking.

Consultation with accredited piping engineers and contractors, experienced in brewery design, is recommended when planning any phase of the various processing systems.

To simplify planning, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information.

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	2	Fig. 275 Bronze Gate	Shutoff steam to heater
B	1	Fig. 586-P Bronze Globe	Bypass to heater
C	2	Fig. 47 Bronze Gate	Shutoff water heater
D	3	Fig. 106-A Bronze Globe	Continuous water flow
E	4	Fig. 204 I.B. Gate	Process steam shutoff
F	2	Fig. 576-P Bronze Globe	Bypass water valve
G	1	Fig. 677-A Bronze Gate	Shutoff cooker mash
H	1	Fig. 677-A Bronze Gate	Shutoff finished mash
J	1	Fig. 677-A Bronze Gate	Shutoff wort to kettle
K	2	Fig. 204 I.B. Gate	Shutoff steam to kettle
L	1	Fig. 576-P Bronze Globe	Bypass to kettle
M	1	Fig. 677-A Bronze Gate	Shutoff wort line
N	2	Fig. 677-A Bronze Gate	Pump shutoff
P	1	Fig. 352 Bronze Swing Check	Prevent backflow
Q	6	Fig. 677-A Bronze Gate	Shutoff coolers
R	1	Fig. 677-A Bronze Gate	Shutoff open fermenter
S	1	Fig. 677-A Bronze Gate	Shutoff closed fermenter
T	2	Fig. 677-A Bronze Gate	Krausen line
U	2	Fig. 675-A Bronze Gate	Water to closed fermenter
V	2	Fig. 675-A Bronze Gate	Water to open fermenter
W	2	Fig. 677-A Bronze Gate	Shutoff storage
X	1	Fig. 677-A Bronze Gate	Shutoff rack & bottling
Y	1	Fig. 675-A Bronze Gate	Shutoff well water
Z	1	Fig. 352 Bronze Swing Check	Prevent backflow

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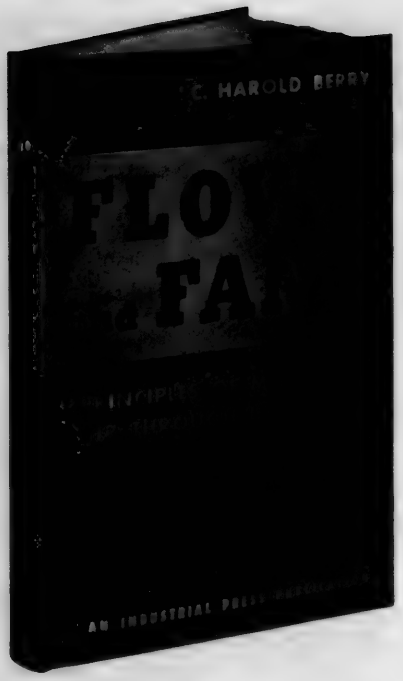
To help you solve your problems ...

A BASIC TEXT ON AIR HANDLING



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"Flow and Fan" will help you solve your problems of moving air through ducts, and the selection and control of fans. It covers the *how* and *why* behind the basic calculations in the design of systems, giving information that is applicable to the actual problems you meet in ventilating work.

The title is derived from the two major divisions of the book: the *flow* of gas through duct systems, and *fan* performance and control. Seven chapters on gas flow give the basic data you need and describe the methods used for calculating system resistance. The final six chapters are devoted to information that will help you in the practical task of selecting a fan for a given duty. Because of this treatment, "Flow and Fan" will meet the needs of students who are interested in acquiring a working knowledge of ventilation, and will be useful to practicing engineers as well.

The author possesses both engineering and teaching experience; and in addition he has the rare ability to write entertainingly about a technical subject without over-simplification, but with practical attention to the limits of engineering accuracy.

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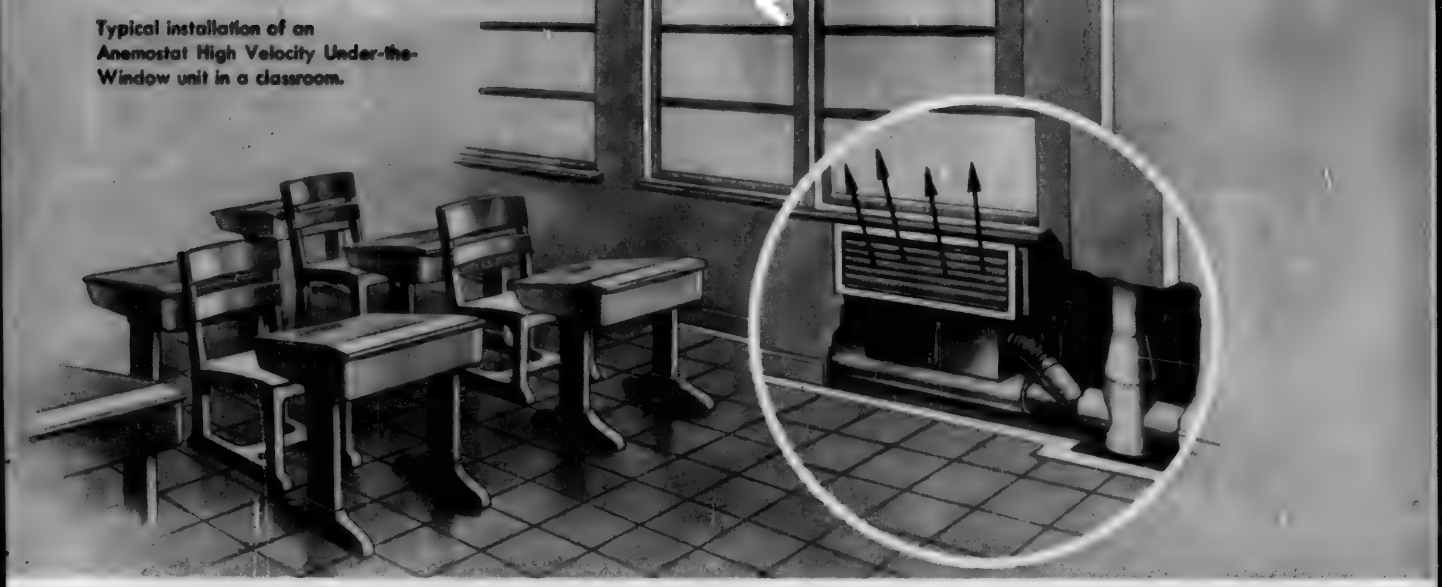


Typical installation of an Anemostat High Velocity Under-the-Window unit in a classroom.

How to deliver

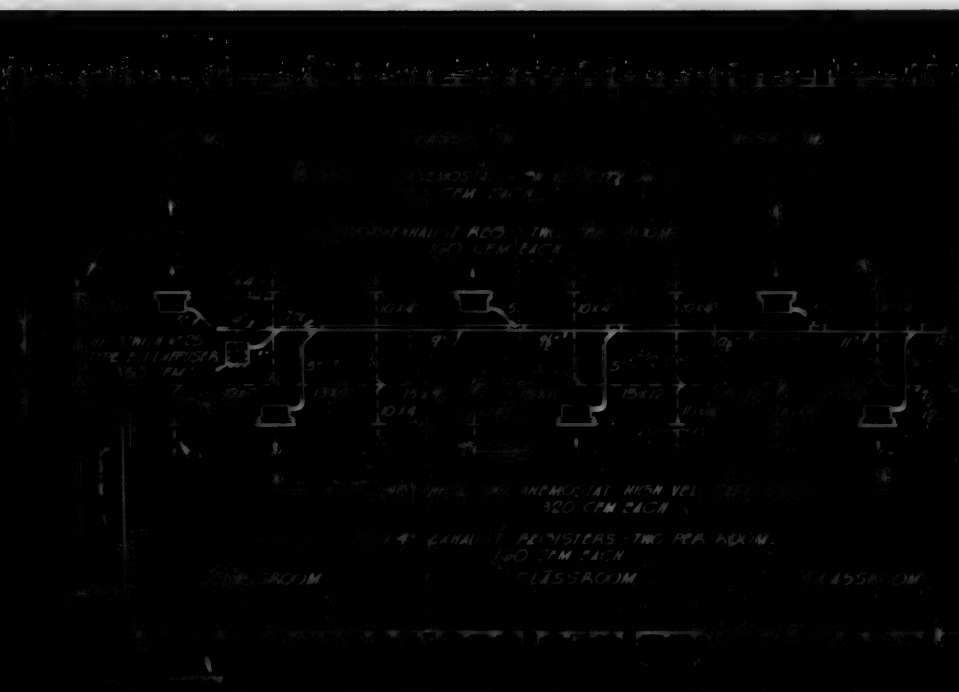
high velocity air to schoolrooms

Shown here are two ways of using the Anemostat All-Air High Velocity system of draftless air distribution for heating and ventilating schools. Under-the-Window units (above) are the most practical for colder climates. Corridor distribution (below) is preferable in warmer climates.

Advantages:

- All-Air High Velocity units require smaller than conventional ducts, thus save space and money.
- All-Air HV units can be used for individual or zone control, in single or dual duct installation.
- Since air is supplied from the main equipment room, there is no need to break through the outside of the building for prime air make-up. This eliminates grilles, dampers, possibility of leaks.
- The Anemostat All-Air HV system can be simply installed by the sheet metal trades. No supply or return pipes are required. Units are quiet, need a minimum of maintenance from custodians.

For latest data on All-Air High Velocity units, write on your business letterhead for new Selection Manual 50 to Anemostat Corporation of America, 10 E. 39 Street, New York 16, N. Y.



Diagrammatic layout shows corridor distribution of high velocity air for wing of school.

Series G Thermostatic Trap

Standard Pressure Range 15 pounds to 25 inches vacuum

Series 45 Steam Trap

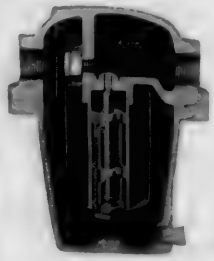
For pressures between 400 and 600 lbs. Body and Cover of special steel

from 25" vacuum to 600 lb. pressure

Illinois STEAM TRAPS

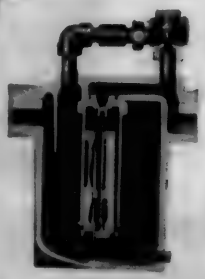
Series G Float and Thermostatic Trap

Standard Pressure Range 15 pounds to 25 inches vacuum



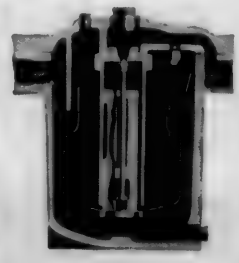
Number 30 Steam Trap

For Pressures up to 150 pounds



Series 36 Steam Trap

For pressures up to 30 pounds



Series 35 Steam Trap

For pressures up to 250 pounds

Prevent Steam Waste—Save Fuel

No matter what your condensate drainage problem may be—for low, medium or high pressure steam or compressed air service—there is an Illinois Trap exactly suited to do the job efficiently, economically. You have a wide variety of types and sizes from which to choose. Before your next trap purchase investigate Illinois with its outstanding record for preventing steam waste and saving fuel. The Illinois representative nearest you will furnish facts and figures—or write for bulletins.

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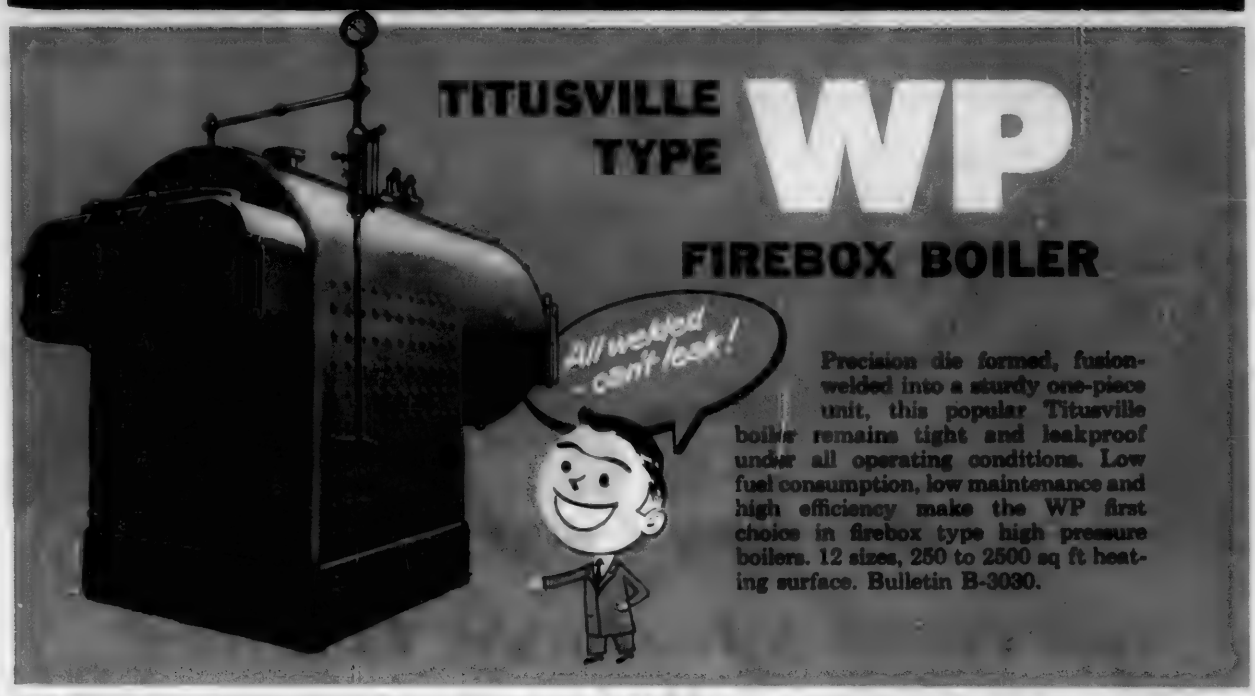
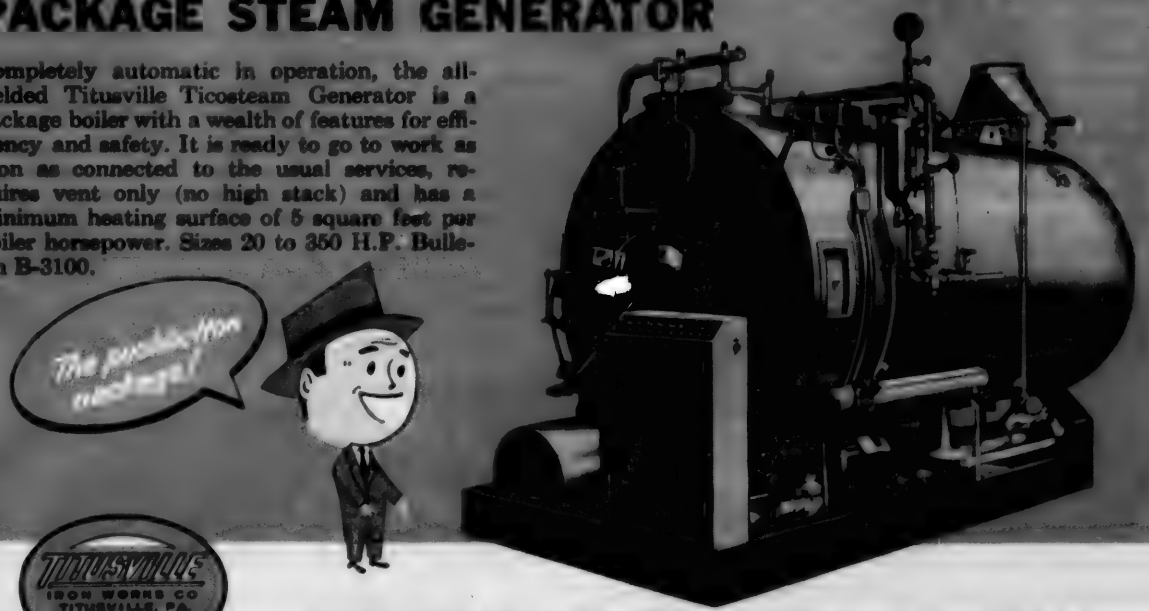


TITUSVILLE TYPE WP FIREBOX BOILER

Precision die formed, fusion-welded into a sturdy one-piece unit, this popular Titusville boiler remains tight and leakproof under all operating conditions. Low fuel consumption, low maintenance and high efficiency make the WP first choice in firebox type high pressure boilers. 12 sizes, 250 to 2500 sq ft heating surface. Bulletin B-3030.

TITUSVILLE Ticosteam PACKAGE STEAM GENERATOR

Completely automatic in operation, the all-welded Titusville Ticosteam Generator is a package boiler with a wealth of features for efficiency and safety. It is ready to go to work as soon as connected to the usual services, requires vent only (no high stack) and has a minimum heating surface of 5 square feet per boiler horsepower. Sizes 20 to 350 H.P. Bulletin B-3100.



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Manufacturers of **A Complete Line of Boilers for Every Heating and Power Requirement**

Radiant Heating Used to Provide Maximum Comfort for Cerebral Palsy Patients

A complete radiant heating system of USS National Steel Pipe has been installed at the Walter D. Matheny School for Cerebral Palsy Children, Peapack, N. J., to insure heating comfort for the patients and to keep operating costs of the institution at an efficient low.

The majority of the pipe used in private rooms was ¾-inch standard. Supply mains through the hallways were laid in sizes up to 2 inches diam.

In installations such as this, where dependability, efficiency and economy are the prime considerations, architects and contractors almost inevitably turn to National Pipe. They have been specifying National, in fact, for over 60 years as the "standard" for conventional plumbing and heating systems. And why not? National Steel Pipe has every characteristic necessary to meet the requirements of such applications—smooth, uniform bending; sound, strong welding properties; and long service life. These are the characteristics that have made National the largest selling pipe in the world.

Write *now* for complete details on the use of USS National Steel Pipe for radiant heating and snow melting applications. Ask for Bulletin No. 19. And keep National in mind for your next installation.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
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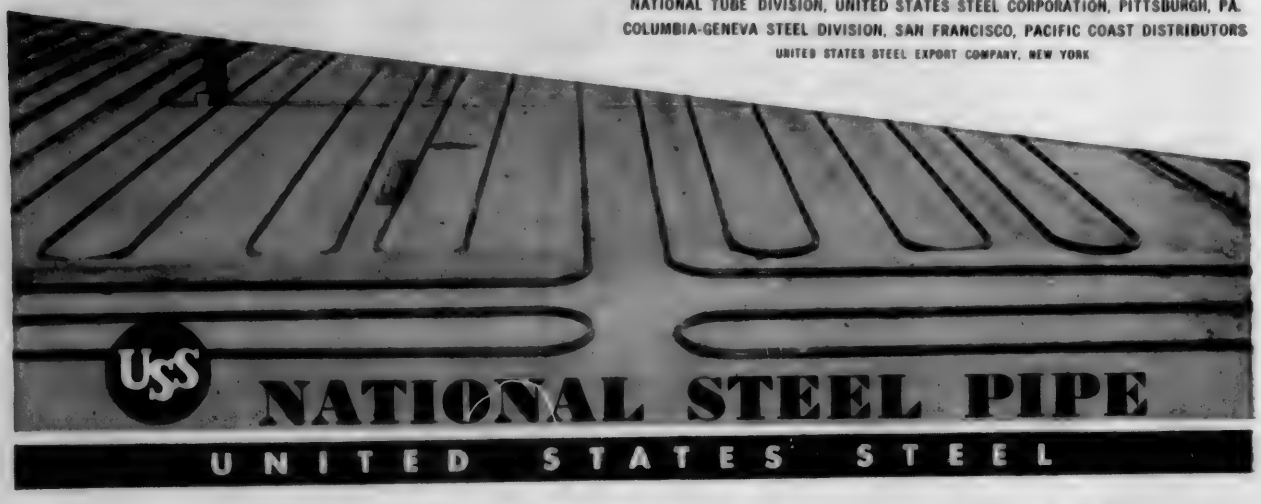

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FOR EVERY TYPE OF COMMERCIAL AND INDUSTRIAL SERVICE

Ventilation and air conditioning engineers recognize the Model WKE dry-panel filter as the most efficient unit of its kind on the market today. Wide range of media is available — it operates at maximum efficiency with any medium that comes in sheet form and can be crimped. Because of its extreme versatility, the Staynew WKE filter may be used for hundreds of varied applications.

- Greater filtering area, size for size, than competitive panels.
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THE STERLING, MIAMI BEACH'S NEWEST ocean front hotel, enjoyed a banner first season last winter. Owner David Rosner assigns a good share of the credit to his Worthington-engineered air conditioning system which cools the 142 rooms and 186,000 cubic feet of dining and lobby space. "Maintenance service (routine checkups) couldn't be better," says Manager Sam Rosner, with an eye on the potential business losses (running into thousands of dollars) that might follow mechanical breakdown. System includes both central and packaged air conditioners.

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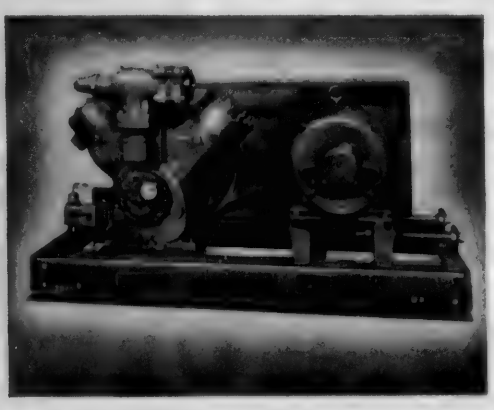

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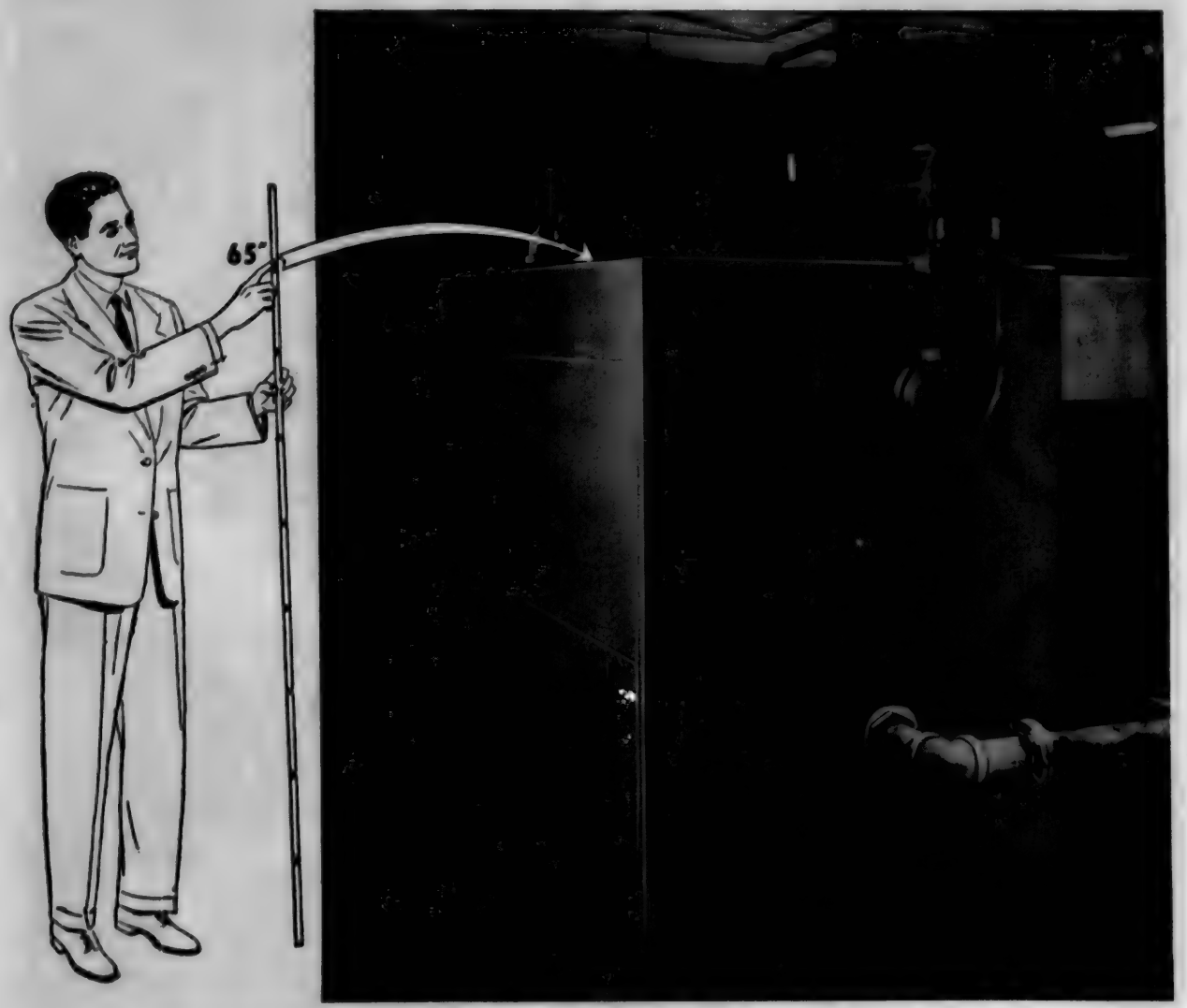

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For more information write to AMERICAN-Standard PLUMBING AND HEATING DIVISION, American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pennsylvania.

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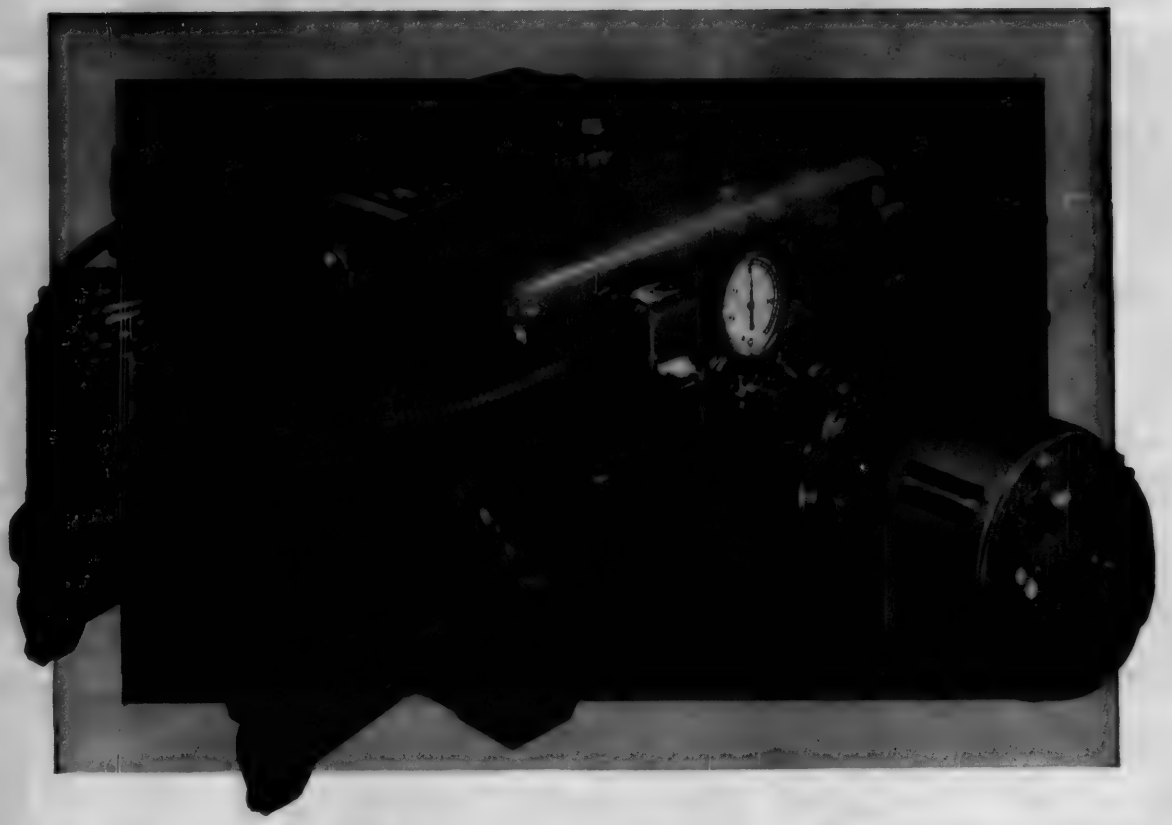

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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Applied Solar Energy

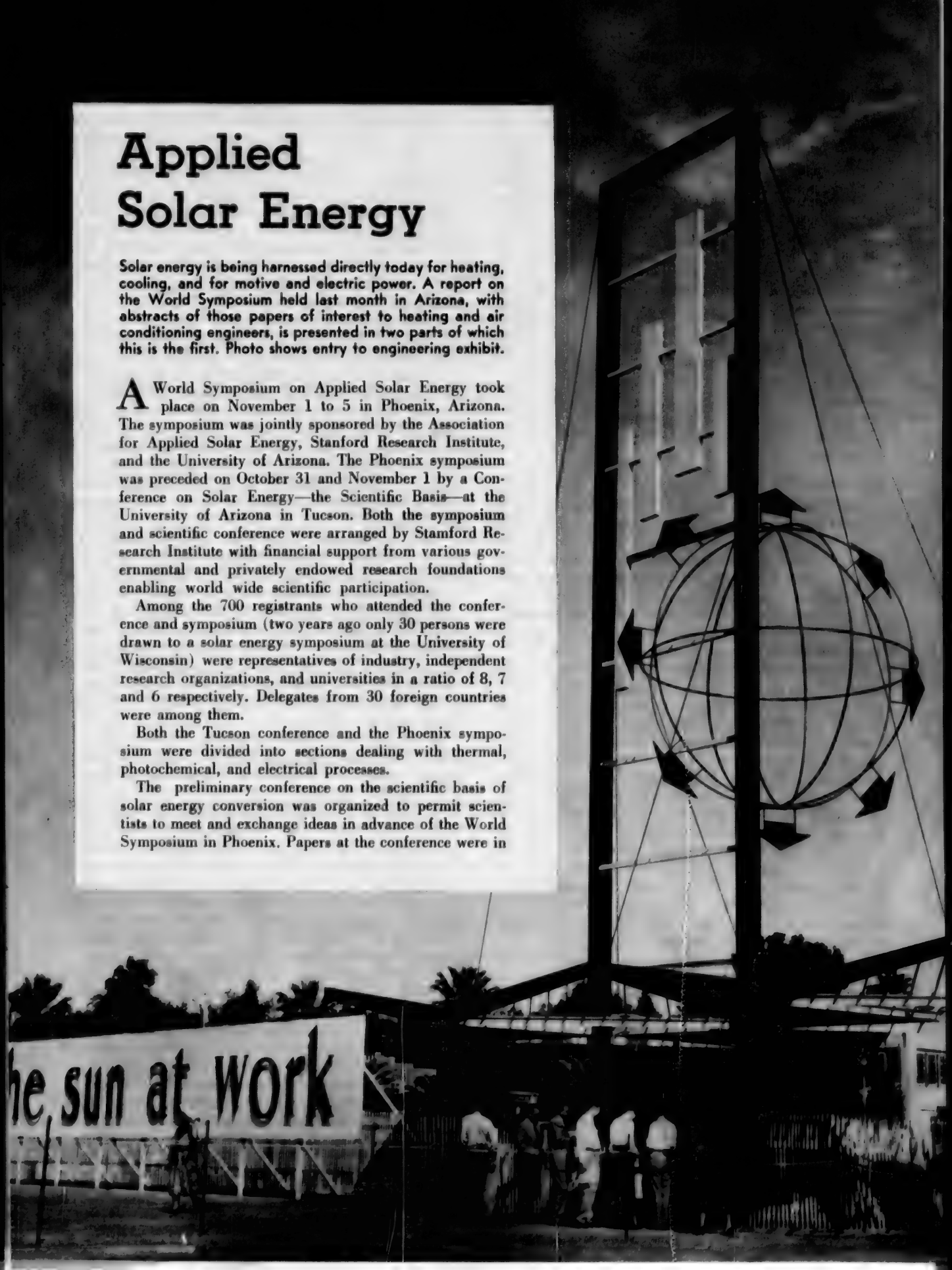
Solar energy is being harnessed directly today for heating, cooling, and for motive and electric power. A report on the World Symposium held last month in Arizona, with abstracts of those papers of interest to heating and air conditioning engineers, is presented in two parts of which this is the first. Photo shows entry to engineering exhibit.

A World Symposium on Applied Solar Energy took place on November 1 to 5 in Phoenix, Arizona. The symposium was jointly sponsored by the Association for Applied Solar Energy, Stanford Research Institute, and the University of Arizona. The Phoenix symposium was preceded on October 31 and November 1 by a Conference on Solar Energy—the Scientific Basis—at the University of Arizona in Tucson. Both the symposium and scientific conference were arranged by Stamford Research Institute with financial support from various governmental and privately endowed research foundations enabling world wide scientific participation.

Among the 700 registrants who attended the conference and symposium (two years ago only 30 persons were drawn to a solar energy symposium at the University of Wisconsin) were representatives of industry, independent research organizations, and universities in a ratio of 8, 7 and 6 respectively. Delegates from 30 foreign countries were among them.

Both the Tucson conference and the Phoenix symposium were divided into sections dealing with thermal, photochemical, and electrical processes.

The preliminary conference on the scientific basis of solar energy conversion was organized to permit scientists to meet and exchange ideas in advance of the World Symposium in Phoenix. Papers at the conference were in



general beyond the scope of this presentation, but will be published in proceedings of the Association for Applied Solar Energy. Response to the invitation for papers was such that there were concurrent sessions presenting sixty-eight papers on the first day of the conference.

Dr. Farrington Daniels of the University of Wisconsin, introducing his discussion of basic principles and problems, said he thought this conference might give as much international impetus to solar power as the recent Geneva conference did to atomic energy. Dr. Daniels envisions solar power and atomic power as developing together, with atomic power handling heavy loads in urban areas while solar power supplies the smaller unitary demand typical in rural areas.

At present, he said, the conversion of solar energy into usable forms costs more than conventional power sources. New technology and new ideas will be required before solar energy is widely available on a competitive basis.

The World Symposium in Phoenix was organized to review recent developments and to bring together scientists, engineers, and business men for the purpose of reducing to practical form the findings of the laboratory. Following are abstracts from some of the papers at the symposium.

Association Formed

Henry B. Sargent, president of the Association for Applied Solar Energy, at the opening session of the symposium on November 2, described how the idea for the association was conceived as a result of conversations between himself and Dr. Daniels some two years ago. Mr. Sargent is president of the American and Foreign Power Company, a multi-billion dollar utility operating in Latin America, and is former president of the Arizona Public Service Company.

It seemed desirable, said Mr. Sargent, to have an association which could form a vehicle, not only to encourage further scientific and engineering work in connection with solar energy, but which could serve as a means of presenting to industry and business accurate information on the present state of the art. Accordingly, on March 17, 1954, Mr. Sargent met with a group of men from industry, agriculture, finance, and education who agreed that additional steps should be taken to meet the problem of greatly increased world requirements for energy. In order initially to supplement such sources as fossil fuels and nuclear energy and to replace them to a greater or lesser extent in the future, it was decided to attempt to bring the major research sources of the world to bear on the field of solar energy before world energy supply became a critical problem.

In recognition of the world wide implications of the effort, an advisory committee was formed consisting of the following: Lewis W. Douglas and Merritt L. Kastens, general chairman and vice chairman respectively, both of Stanford Research Institute; C. G. Abbot, Smithsonian Institution; Vannevar Bush, Carnegie Institution; Godfrey L. Cabot, Godfrey L. Cabot, Inc.; Farrington Daniels, University of Wisconsin; L. J. Heidt, Massachusetts Institute of Technology; Harold Heywood, University of London; Hoyt C. Hottel, Massachusetts Institute of Technology; George O. G. Löf, consultant; Eugene Rabinowitch, University of Illinois; Maria Telkes, New York University; Felix Trombe, director of the Laboratory of Solar Energy, Paris; E. J. Workman, New Mexico Institute of Mining and Technology; and Frank Lloyd Wright, architect.

Where We Stand

Dr. Farrington Daniels, discussing the sun's energy in general, noted the burgeoning interest among scientists and engineers in the subject of solar energy and warned that there is no sudden era of solar prosperity just around the corner. None of our present engines and generators will be rendered obsolete by solar energy. Atomic energy and solar energy each in its own way will merely supplement the new additions to our power producing machinery. Solar energy, since it lends itself to smaller units than atomic energy, will probably come into general utilization first in rural areas.

In explaining the sudden upsurge of interests in the utilization of solar energy, Dr. Deniels pointed out that the technological and inventive resources of the world are centered in industrialized areas where competition with cheap fossil fuels has been unattractive. These conditions are changing however and there is increasing realization that the fossil fuels, coal, oil, and gas, will not last forever. Some countries are already feeling the pinch of a decrease in high grade easily mineable coal. Moreover, the population of the world is increasing rapidly, and the demands for abundant energy are increasing still faster.

Another important factor has been the realization, through advances in transportation and communication, that the non-industrialized areas of the world afford fertile ground for the benefits of this new source of power. Dr. Daniels sited an operation in India, where the work done by four bullocks and two men on an irrigation project calculated out to be equivalent to 1/3 of a horsepower. If the bullocks' walkway around the irrigation well were covered with a solar heat collector operating a crude engine at only one per cent efficiency, a one horsepower pump could be operated.

Dr. Daniels pointed out that, since the solar energy source is nominally free, efficiency of conversion is less important than low capital investment and small repair requirements.

Still another factor in our awakened interest in solar energy is the development of new materials. While the large areas of machinery, metals, glass, and concrete associated with solar heat collection may run into thousands of dollars per acre, some of the new thin plastics which cost only hundreds of dollars per acre may open new frontiers toward making solar devices more economical.

Turning to the abundance of solar energy, Dr. Daniels pointed to the fact that in order to carry on the civilization of the United States, this country used 186 kilowatt hours of fuel energy per person per day in 1952. The total energy from the sun striking the land area of the United States is of the order of 313,000 kilowatt hours per person per day.

Dr. Daniels commented upon the cumbersome numbers involved in the use of conventional small units of energy and area in connection with solar energy utilization. He suggested a new unit of solar energy, the roof, which is a million calories per minute. It is a mean value of the total solar radiation received during the day by 100 square meters (1075 sq ft) of flat surface; about the flat

area of a roof of a square house which is 33 feet on a side. A roof-day of solar energy is equivalent to 1.9 million Btu.

Dr. Daniels believes that, by a judicious combination of fossil fuels, atomic energy, and solar energy, the whole world can have within this century, all the mechanical power and material comforts that it wants.

Economics of Solar Energy

A staff paper presented by J. E. Hobson, director of the Stanford Research Institute, explored the economic possibilities of solar energy. In the not too distant future, said Dr. Hobson, we will be confronted by an imminent, ominous shortage of the fossil fuels and other energy sources packaged and stored for us through action of the sun. Men of this generation must prepare today for this coming crisis. The atom may supply the bulk of energy requirements in the world of tomorrow, but it is complex and vastly expensive and relies on a highly developed scientific and industrial background for its use. Solar energy must become a complimentary resource and its many technical and financial riddles must be solved.

Direct use of energy from the sun offers immediate, specific economic opportunities. Some have already been developed. Engines have been operated with solar power; water has been lifted by solar powered pumps; solar furnaces have produced exceedingly high temperatures; solar ovens can cook our basic foods; houses have been heated by solar devices. Solar cooling and direct solar electricity are physical if not economic facts of life today.

Today, said Dr. Hobson, we can speak with some assurance about the cost of solar pumps and solar cookers; we can accurately assess measures for reducing the cost of solar distillers or house heating installations. Roughly speaking, we are in a field where solar thermal devices are economical now, or could become so after moderate cost reductions. In this field, today, the industrialist, the engineer, and the economist can meet and work together for profit.

The economic position of solar devices is similar to that of hydroelectric generating stations in that high initial cost can be offset by low maintenance and fuel charges. The economics of hydraulic energy and solar energy alike will therefore be affected appreciably by such factors as the cost of money, taxes, the life of the equipment, and prices for competing energy.

The localized nature of solar devices and the world wide availability of solar energy will emphasize the wide regional differences in price for conventional energy. An index of the least expensive form of conventional energy available today in a survey of eighteen cities throughout the world shows that the wholesale fuel prices vary from an index of about 60 in Mexico City to more than 600 in Casablanca. It seems apparent, said Dr. Hobson, that conventional energy prices often become the critical factor in making many solar devices economical where adequate solar radiation is available. Local labor and materials cost will also affect the economic attraction of solar energy.

Another factor affecting the economics of solar energy is the distribution pattern of the energy in a particular locality. An average value for radiation over a rather long period of time must be modified by consideration of the variation within that period of time since it effects the size and hence the cost of the collector needed.

The economic advantages of large producing units do not apply to solar energy devices, because the major cost factor is in the area of the collector. That area must be doubled to double the capacity. Ordinarily the net gain from doubling the size may not be sufficient to overcome the additional operating difficulties. We may never build solar power plants with a capacity of 100,000 kilowatts, but we may well build 10,000 plants, each with a ten kilowatt capacity.

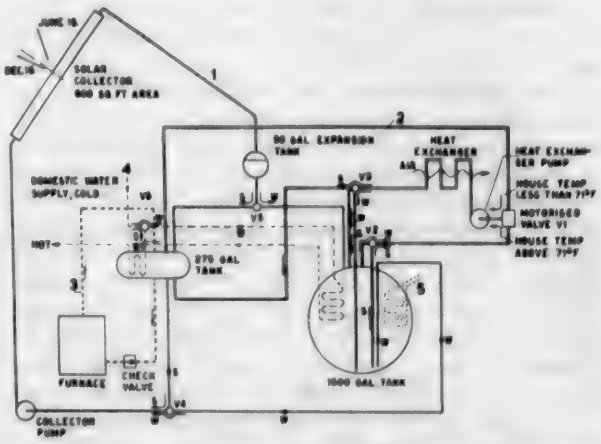
Within the so-called solar belt between the 40-degree parallels of latitude, solar water heating is in general economical today with present methods in places where the retail price of conventional energy exceeds around $1 per million Btu and where adequate sunshine is available.

There does not appear to be an economic potential now for solar house heating in most of our eighteen selected cities, said Dr. Hobson. However, solar house heating is more economical where the cold season is long and the weather clear, since longer heating means a higher use factor. There are many locations, especially in the mountains, where solar space heating can be utilized economically today.

Solar House Heating

The design of a solar heated house for the New England region was described in a paper by Austin Whillier, formerly a research associate at Massachusetts Institute of Technology and presently research officer of the council for scientific and industrial research, Pretoria, South Africa, The paper, a publication of the Godfrey L. Cabot research project at MIT, outlines procedures followed in designing a solar heated house with emphasis on optimum cost and efficiency factors. It is shown that a house designed for between 50 and 75% solar heating represents the optimum degree of solar heating, and that such a system is comparable in cost with conventional house heating systems.

The design finally produced is for a two story house with partial basement for the heating equipment and with



M.I.T. Solar house heating system. (1) Collector circuit; pump on when sun shines. (2) Heat-exchanger circuit; pump and motorized valve controlled by house thermostat. (3) Furnace circuit; flow by natural circulation whenever furnace is on. In Winter furnace keeps 275-gal tank between 135 degrees F and 150 Degrees F., in Summer it is turned off. (4) Domestic hot-water circuit; the heating coil in the large tank is by-passed during the Summer. (5) Evaporator (Freon) coil of the ¾-ton refrigerator; used in Summer only.

a floor area of 1100 to 1200 square feet. Ratio of length in the east-west direction to width in the north-south direction is between 1.1 and 1.5. A south facing solar heat collector is tilted at an angle preferably between 55 and 60 degrees and has an area preferably between 500 and 600 square feet. Water is used for heat storage and for removal of absorbed solar energy from the collector. A perimeter forced air system is used for heating the house. Auxiliary heating is by means of an oil furnace. Cooling of the house during the summer is effected by means of a ¾ ton refrigerator used in conjunction with the large water storage system. The storage system for a 600 square foot collector contains 1500 gallons of water. Operation of the system is entirely automatic except for the manual switchover from winter to summer operation.

Auxiliary heating by the oil furnace is used only if solar energy is insufficient to maintain comfort. Domestic hot water is heated by the sun throughout the year with auxiliary heating as required.

The tilted collector was deemed preferable to the south facing vertical collector, because heat output of the tilted collector is 10 to 15% greater than that of the verticle collector during critical winter months of December, January, and February and even more during the rest of the heating season.

Optimum size of collector was determined by plotting the cost of the various fractions of the auxiliary heating required for each month as a function of collector area and relating the cost per unit of heat to the cost per unit area of collector. For this particular house the optimum area was established at 600 sq ft. Such a collector would require auxiliary heating to the extent of 20% of the total heat requirement over the year and about 50% of January heat requirement.

The primary factor dictating choice of a house heating system is the desire to operate the solar collector at the lowest possible temperature. This limits the choice of system to those with large areas for heat transfer such as forced air and panel systems.

Returns for the forced air heating system were located so as to draw off the coldest air possible for return to the heating system. This is important because of the desire to operate the solar collector at the lowest possible temperature. To heat the air for circulation through the house, a water-to-air finned coil heat exchanger is used.

The maximum demand for heat was to be met using hot water at 135 deg F. The average winter heat load was to be satisfied from the solar storage tank alone, provided that the storage temperature was greater than 100 deg F. With 100 deg storage water, the temperature of air entering the house was to be not less than 85 deg.

Storage water is contained in two tanks, one of 1500 gallons and the other 275 gallons capacity. The large tank is used for heating in winter and for cooling in summer, while the small tank is used for auxiliary heating in winter and solar water heating in summer.

The expansion tank performs two functions. First is the conventional one of allowing for volume changes in the water as a result of temperature changes. The second is to enable the solar collector to drain automatically when the collector pump is turned off. Volume of the expansion tank must be greater than the thermal expansion volume by an amount equal to that of all tubes in the collector including connecting tubes.

One of the main difficulties still to be overcome is the construction of weatherproof solar collectors at a reasonable cost. The materials themselves are expensive, and the installing trades are not yet skilled in the details of installation procedure.

Solar House Heating

For a panel discussion on solar house heating, Dr. Maria Telkes of New York University reviewed research projects which have been conducted with solar heat collectors. Pointing out that for collectors using air or water heated behind a black plate, use of multiple air spaces between panes of glass can diminish heat loss, but increasing number of panes diminishes the transmission of solar energy. A collector with 2 or 3 glass panes represents the usual practice at this time. Dr. Telkes described experimental work at NYU now being carried on with the aim of decreasing heat loss from a solar collector. It was found that heat loss from a standard black plate through two or three layers of glass is predominantly due to reradiation, being 70 to 85% of the total heat loss in the temperature range of 100 to 500 deg F. Aluminum alloy back plates with an emisivity of 0.25 lose only 52 to 69% due to reradiation. It is suggested that aluminum may be coated with a selective black paint which absorbs only the solar wave lengths but does not emit longer wave lengths. Experimental work is now in progress to find selective black coatings.

The paints using black semi conductors such as carbides, borides, nitrides, and silicides as pigment in a plastic vehicle have shown improved collector performance in comparison with the standard black widely used for painting solar heat collectors.

A comparison of heat storage capacity on a volume basis between various storage media shows that water can store 62.5 Btu per cubic foot per deg F while rocks, bricks, and gravel can store about 36 Btu per cubic foot per deg F. The storage-volume ratio can be raised by using the heat of fusion of various salts which melt within the desired temperature range. Such salts can store about 60 Btu per cubic foot per degree as specific heat and 9500 Btu per cubic foot at the melting point as heat of fusion.

The problem in using the heat of fusion of salts is the fact that when these materials are melted completely in sealed containers they tend to undercool rather than crystalize during the cooling cycle. While undercooling can be prevented by using nucleating agents, the user is still faced with the fixed rate of crystal growth which is very slow in most salt hydrates. Heat cannot be withdrawn more rapidly than it can be supplied by the growth of the crystals; and for practical purposes formation of crystals does not progress more rapidly than at the rate of 0.5 in. per day. This difficulty may be partly overcome by design of the geometric shape of the container to provide large heat transfer area.

Development and use of low cost heat storage materials is essential for the economical solution of solar heating, Dr. Telkes said.

A Solar Engineering Exhibit, concurrent with the Symposium, is described in this month's News pages. Next month, the balance of abstracted papers, covering solar power, heating, cooling, water heaters, and mechanical, chemical and electrical converters will be published.

Fig. 1. Blower, operated through a V-belt drive, draws air through motors and generators in a motor room.

While much has been written on the theory of belt tension, here are simple, practical methods that enable one to attain the proper grip or tension in V-belts. The suggested corrective measures are simple to follow.

Practical Methods for Proper V-Belt Tension

FRANK H. RUMBLE

Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

ANYONE at all familiar with the modern multiple V-belt drive is aware that a V-belt derives its grip from the wedging contact between the sides of the V-shaped belt and the sides of the V-shaped grooves of the sheaves. Because of this wedging contact, a V-belt requires less tension than a round or flat belt which depends for its grip solely on frictional contact with the sheave surface.

This very fact sometimes causes trouble. Because of the effectiveness of their grips and the generally accepted fact that they do require less tension than other types, there is often a tendency to apply too little tension on V-belts. Experience shows that there are a great many more V-belt drives operating with insufficient tension than there are drives with too much tension. Drives with slack, sagging belts almost always need more tension Proper adjustment will often remove the sag and cause the belts to operate more uniformly and efficiently.

Even though the V-belt drive requires less tension than other types, to operate correctly and assure longest life of both belts and sheaves, a V-belt drive must have some tension on the belts; otherwise the belts will slip while in use, quickly wearing both belts and sheave grooves. Also, slack belts have a tendency to whip, jerk and not operate in unison. The question is, naturally, what is the correct amount of tension for V-belts and what is a practical means of attaining it? Before attempting to answer these questions, let us examine a few other facts.

Like a pair of new shoes, V-belts when first installed need a breaking-in period. Over the period of their useful working life, standard V-belts of rubber, cord and fabric will show a total stretch of approximately 4%. The stretch is effected gradually and may only become apparent after the belts have been under proper tension for a relatively long period. However, a small amount of this stretch occurs soon after belts have been installed and until they reach their working length. After this initial stretch is removed, the belts resist further give and retain a large share of their elasticity.

Belt Can Be Too Tight

It is possible, of course, to put so much tension on a V-belt drive that the belts themselves will be tight as fiddle strings. The belts will be unduly stretched and the bearings of motor and driven machine overloaded and damaged. However, this danger is not too great and is not frequently encountered unless excessive tension is applied deliberately and without reason. All that is necessary on the average properly engineered drive is to apply enough tension to prevent slipping of the belts under full load. Slippage can readily be detected by use of a tachometer applied to driver and driven sheaves. If an excessive amount of tension is required to keep the belts from slipping, the engineering of the drive should be checked. Perhaps the drive should have larger diameter sheaves or more belts. Use of high capacity type belts may offer a solution.

The phenomenon of belt sag is well known but the facts in connection with it are often misinterpreted. Sometimes on a matched set of belts which has been in use, and frequently with newly installed matched belts, some belts will sag more than others and appear to be considerably longer. Actually, this is not the case. In the modern method of matching V-belts the maximum differ-

Fig. 2. V-belts under proper tension feel springy and alive when slapped with the palm of the hand.

ence in length between longest and shortest belts in the set is only 1/10 in. per 100 in. of belt length, or 1/10 of one per cent. The amount of sag this may produce is deceiving. On a center distance of 100 in. on drives with both shafts parallel to the floor or base, a sag of two inches in a belt will appear drastic, yet it can be removed by only 0.054 in. of take-up on the motor base—less than 1/16 in.

Stretching the shorter belts in the set, this small amount, to bring them up equal with the others, will not harm them. In fact, considerably more than this amount of stretch must be applied to all belts in the set. Research has shown that V-belts operate best when under slight stretch, which is, of course, induced by putting them under tension. That is the reason the belts are made resilient and elastic—a necessary attribute of V-belts working in multiple. Belts under proper tension are operating under approximately one-half of one per cent stretch.

It is impractical in the average shop or factory to actually measure the pounds of tension which are applied on a V-belt drive, such as can be done in the laboratory with special equipment. Exact measurement is not necessary. It is sufficient to have practical ways of approximating the correct tension. The experienced operator can tell by observation and feel whether or not a set of V-belts is under proper tension. Unless the drive has an unusually long center distance, the belts under proper tension have little, if any, sag. A slack V-belt feels dead when thumped with the hand while a properly taut belt, Fig. 1, has an alive springiness.

There are other ways of judging whether or not a V-belt drive has the proper tension. One way is by use of a tachometer as previously mentioned. After a set of belts has been installed, all the slack removed and the drive started up, the rpm of the driver shaft can be checked with the rpm of the driven shaft according to speed ratio. Tension should be applied only to the point where no slippage is evident. The procedure should be repeated every few days until the belts are broken in and set properly.

Another method favored by some operators is that of depressing the belts as shown in Fig. 3. With the drive stopped, press down firmly on each individual belt. A belt which can be depressed an amount equal to its own thickness for each 48 in. of unsupported length, is properly tensioned. This allows for the fact that the larger the cross section, the greater the amount of tension required. Where 48 in. of unsupported length is not available, a proportional amount of pressure should be exerted.

Still another way of quickly attaining the approximate correct tension when installing a set of belts is to proceed as follows. After belts are fitted in the grooves properly, move the motor away from the driven machine just to the point where belt sag is eliminated. Indicate the exact center distance by making a chalk or pencil mark on the motor base. Then make an additional take-up of ½ in. for each 100 in. of center distance. Proportionate take-up should be made on longer or shorter center distances. This will approximate about ½ of one per cent stretch and put the belts under the proper tension. They should be checked after the first few days use with the hand-thumping or depressing method to be sure they have not loosened up. If so, more take-up will be required.

Fig. 3. A method of checking tension by depressing the belts, one at a time. When under proper tension, the belt can be depressed with reasonable pressure.

Air Conditioning a New Hotel Ballroom

The newly-opened ballroom and exhibition space is a two-story addition to Washington's Sheraton-Park hotel. It has a Trane air conditioning system so flexible that it can serve as many as 3,000 or only 500 persons in the ballroom.

The entire air conditioning system consists of two large fan systems which serve the 20,000 sq ft. ballroom and 16,000 sq ft lower level display area. There are several Climate Changers for such areas as the balcony, foyer and kitchen.

This system as a whole is designed to provide fresh, cool, filtered air, and to remove several tons of moisture per hour from the air. Washington has nautral high humidity, and the moisture given off by as many as 3000 active people contributes to the need for dehumidification. The Sheraton's air conditiong system accomplishes this dual cooling and dehumidifying job by cooling the air to a low dry bulb and wet bulb temperature, then reheating it to the entering temperature required to maintain comfortable temperature conditions.

AIR CONDITIONING, HEATING AND VENTILATING'S

Reference Section

Service Hot Water Design for Multi-story Buildings

FRED M. REITER

Fuel Engineer, The Dayton Power and Light Company, Dayton, Ohio

A comprehensive treatment of service hot water systems for large buildings, which covers water demands, flow through water fixtures and pipe sizing for satisfactory operation. Included are 25 tables useful in design work.

AIR CONDITIONING, HEATING AND VENTILATING — DECEMBER, 1955

Service Hot Water Design for Multi-story Buildings

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Intelligent design of service hot water systems for multi-story buildings is predicated on many factors. Factual information plus valuable graphs are presented to show how hot water demand may be computed for various applications and hour of the day, pipe sized, and heat losses determined. Included are helpful design tables.

GREATER utilization of hot water for personal uses, sterilization and cleanliness, has increased the amount of hot water required in multi-story buildings such as apartments, office buildings, hospitals and loft buildings. It has directed attention to the need for better planning of service hot water systems.

GENERAL REQUIREMENTS FOR WATER

There is no general definition for hot water. Each job or operation has its own suitable water temperature, whether set up by common practice or by the manager of a specific institution. Most sanitary codes or nationally adopted standards define the conditions of the hot water required for each application under consideration.

One may enter a public place and open a hot water faucet only to find the water that flows may be scalding hot, lukewarm or even cold. A tavern cleanses its glasses or a sandwich shop washes its dishes in clear or treated water frequently below 120 deg F and the resulting bacteria count may be above the minimum bacterial requirements established by public health codes.

Operation Temperatures

Individual skin sensitivities vary. Many people cannot wash their hands in 120 deg water, while others can work in scalding hot water without harm. Temperatures generally desired for the most common operations of the home, commercial and manufacturing institutions are listed in Table 1. These can serve as one of the bases of most computations, as practical areas of operation rather than as specifications. Temperatures dictate most factors of hot water operations, the method of producing the hot water, controls, mixing arrangements, piping and insulation.

Figure 1 is included as a criterion of hot water consumption for hotels and apartment buildings. It is almost axiomatic that hot weather, particularly with accompanying high humidities, increases the consumption of hot water for personal hygiene, laundries and beverage dispensaries. Weather affects hot water costs to some extent in a manner similar to the effect of degree days in winter heating. Figure 1 portrays the belts of common unit consumption throughout the United States where the temperatures are sustained above 85 deg for various numbers of hours per year.

Quality of Hot Water

Probably the greatest use of hot water is for cleaning, whether for the human person or his apparel, home or shop cleaning. With advancing labor costs as well as the scarcity of help for cleaning tasks, technology has entered the sanitary field more than ever before.

Detergents and cleaning compounds have been highly developed, with special soaps for almost each type of job. At the same time, new and special types of floors and walls have come into use, such as polyvinyls, asphalt and rubber base tiles, terrazzo and plastics, each of which now demands some particular compound to produce optimum results.

Of equal importance in larger establishments is the wide use of machines for production cleaning where the type of hot water and cleaning compounds affects the efficacy and quality of cleaning. Most cleaning standards or sanitary codes specify end results in cleanliness, without mention of water quality or temperature requirements. Building supervision inspects the results without any consideration being given to the cleaners' problems of hot water supply.

Water Hardness

Hardness of the hot water used for cleaning purposes gets considerable attention from the building or plant sanitarian. Hardness increases costs of labor and materials, produces poorer results in the finished product, and gives the most trouble in the waste materials or effluents. It increases maintenance in terms of limed heaters, piping and other equipment.

Many cities have installed complete municipal water softening and filtration plants. Natural well or underground waters contain dissolved calcium carbonate, $CaCO_3$, which produces temporary or carbonate hardness. Calcium carbonate dissolves in cold water containing carbonic acid, H_2CO_3, in solution. Neutralizing this acidity with lime water precipitates out the $CaCO_3$ and softens

the water. Alum or ferrous sulfate is added as coagulant to assist in settling the lime precipitates.

Table 2 lists the hardness of the natural waters of the 48 states in terms of parts per million of $CaCO_3$ hardness, and gives the pH value. The pH number is based upon the number of ions of $-OH$ or $+H$ in the solution. Neutral solutions have a pH of 7. All water laboratory facilities have equipment for finding pH values.

Removal of Hardness

Most waters, especially those from rivers into which industrial plants may discharge sulfuric acids, contain some permanent hardness, because of the calcium sulfate, $CaSO_4$ carried in solution. Calcium sulfate is more soluble in cold water than $CaCO_3$. The addition of some washing soda, Na_2CO_3, converts the $CaSO_4$ into the $CaCO_3$ form by exchange, and precipitation removes the calcium permanent hardness. Most large municipal, industrial or power plant water softening plants utilize the lime-soda process for removing all hardness to the extent desired.

Smaller establishments and institutions utilize the ion-exchange softening processes wherein zeolite crystals exchange sodium for calcium ions within the zeolite surfaces and produce soft effluent water. When the zeolite crystals can absorb no more calcium and the water remains hard, sodium chloride salt solution is run through the zeolite crystals to restore their exchange properties. In recent years resins have been developed that are suitable for ion exchange systems. They are designed to withstand acid and alkali concentrations over the entire pH range. They operate effectively in temperatures exceeding 250 deg with contents of chlorine and iron far in excess of any concentrations previously deemed permissible. The rates of flow and exchange greatly widen the application of these materials.

Color, Odor and Taste

Color, odor and taste frequently affect the product with which they are used, such as foods and beverages. They depreciate the value of any waters used for cleaning, sanitation, or for any commercial operations. They may chemically affect some particular uses. Many natural ground waters have sulfurous, iron, alkaline or other properties that are offensive to human senses and, therefore, require some treatment.

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Sterilization

Many bars and taverns legally utilize the newly developed sterilizing and detergent compounds in the direct sterile cleaning of glasses, dishes and cutlery, even in cold water. Among these compounds used are the iodine based and quaternary ammonium chemicals. These have displaced in many cases, chlorinated compounds with superior results. Some of these kill practically all bacteria within three minutes in cold water solutions, well below the 180 deg rinses normally required for sterilization of utensils.

Hot sterilizing water is universally demanded where government supervision is maintained for public food and beverage dispensaries. Bacteria counts check the completeness of sterilization although codes are more relaxed in rural areas. Soaps and detergents serve to separate and

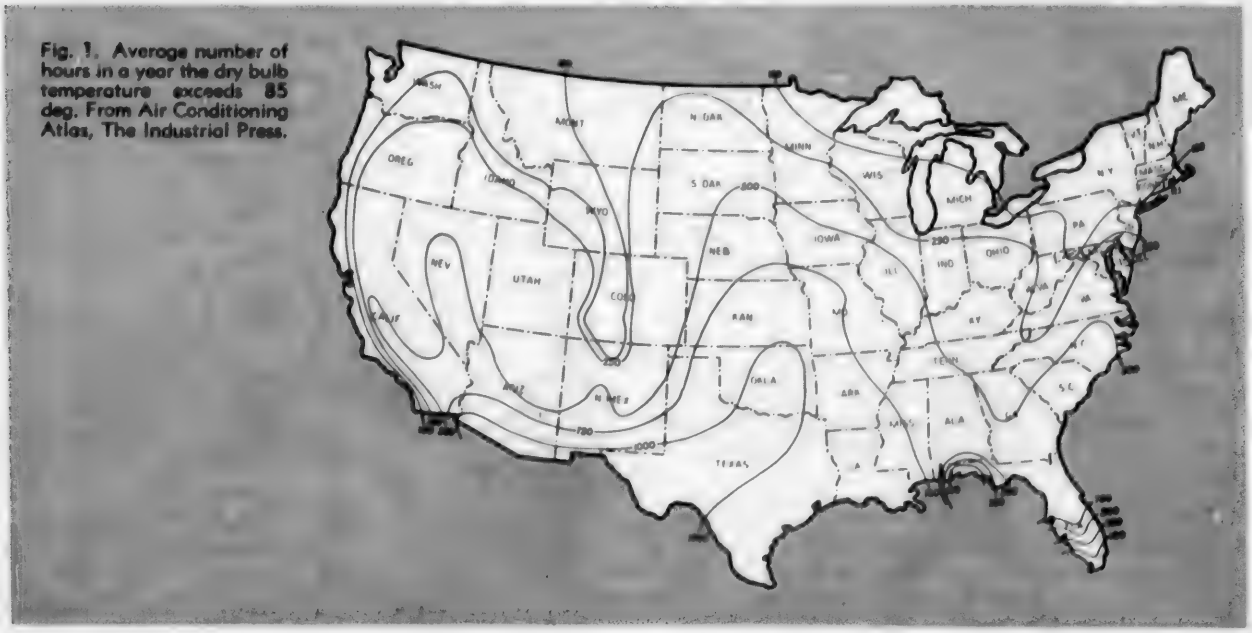


Fig. 1. Average number of hours in a year the dry bulb temperature exceeds 85 deg. From Air Conditioning Atlas, The Industrial Press.

TABLE 1. TEMPERATURE DESIRED FOR VARIOUS OPERATIONS

Use	Approximate Usage Temp., Deg F
Human Needs	
Wash stands for hands, face	102 to 110
Shaving, shampooing	110 to 115
Baths	
Cold	32 to 65
Cool	65 to 92
Warm	92 to 98
Cleansing	102
Hot	98 to 115
Stimulating	105
Torrid	above 115
Washing pets	102
Housecleaning Needs	
Mopping and scrubbing floors	100
Cleaning glass, ornaments	112
Wall cleaning	105
Automobiles	100
Windows	120
House woodwork, painted structures	110
Removing wall paper	140 to 160
Dishwashing Needs	
Home hand-sink or pan washing with towel drying	112
Home dishwashing machine, drying in machine	130
Large continuous machines	
Cleansing solutions (containing detergents)	140
Sterilizing and drying rinses	180
Laundry Needs	
Synthetic fibers, rayons, nylons, dacrons	105
Animal-vegetable fibers, wools, cottons —machine washing	140 to 150
Handwashing	112 to 115
Sterilizing rinses, large laundering machines	180
Hospital, Medicinal Needs	
Sponge baths	105
Hot water bottles	120
Hot applications	135
Sterilizing instruments, equipment	180 to 200
Washing utensils	140
Baking, Cooking Needs	
Blanching fruits, nuts	120
Washing pans, utensils	140 to 160
Cleaning poultry	160
Sterilizing jars, containers	180
Fillings, syrups	180
Water for boilers, soups, steam jackets	140 to 180
Automotive Needs	
Car cleaning (exteriors and body interiors)	110
Removing grease	160
Engine spray cleaning	180

colloidalize or emulsify dirt particles that adhere to the surfaces of the materials to be cleaned. They break up the dirt masses into smaller particles but they do not sterilize water.

Corrosive Effects

The millions of dollars paid out annually for the maintenance of hot water systems testify to the corrosive effects of hot water in pipe lines, tanks, heaters and other equipment. Copper tube has greater corrosion resistance. Corrosion is caused or aided by:

1. The use of soft waters, such as rain or cistern water, because they lack any scaling ingredients that may provide some protection and they are generally highly aerated. Zeolite softened water is frequently ultra-soft and similarly aids corrosion.
2. Dissolved sulfurous or carbonic acids, as found in many ground waters, which have the ability to attack metal surfaces chemically.
3. Use of excessively high temperatures, thus accelerating any chemical action present. Temperatures above 140 deg lead to aggravated corrosion results and brings about other effects.
4. Galvanic action in the system. Leaks will occur where dissimilar metals are joined, such as steel pipe or tanks with copper or brass fittings, steel and cast iron, scale or rust deposits. These localized cells produce pitting and holes.

Corrosion

Some of the methods used to keep corrosion to a minimun are:

1. Use non-corroding metals, especially where very high temperature water is used.
2. Avoid the use of dissimilar metals in the system.
3. Keep temperatures as low as practicable, below 140 deg if possible.
4. Blow-down or drain tanks and exchangers, cleaning out scale and cathodic dirt.
5. Use anodic protection rods or materials in tanks and heaters.
6. Small amounts of corrosion inhibiting chemicals can be used in conjunction with a softening plant. Some hardness might be retained in both zeolite and soda-lime processing in order to avoid complete softness.

METHODS OF HEATING WATER

A number of methods of heating water are being used. Table 3 is a water heater selection chart wherein the quality of the water serves as the basis of the choice. Where hard water is heated, lime deposits become a major factor in the selection of the type of heater. The heating

TABLE 2—CHARACTER OF WATER THROUGHOUT THE UNITED STATES

State	Hardness as $CaCO_3$ in PPM	pH	State	Hardness as $CaCO_3$ in PPM	pH
Alabama	65	6.9	Nebraska	231	7.5
Arizona	254	7.6	Nevada	179	7.5
Arkansas	151	7.1	New Hampshire	22	6.5
California	163	7.7	New Jersey	70	7.0
Colorado	101	7.4	New Mexico	342	7.4
Connecticut	28	6.7	New York	105	7.3
Delaware	81	6.8	North Carolina	48	6.8
District of Columbia	77	7.8	North Dakota	306	7.7
Florida	196	7.2	Ohio	291	7.5
Georgia	76	6.9	Oklahoma	224	7.7
Idaho	85	7.6	Oregon	22	6.9
Illinois	292	7.7	Pennsylvania	118	6.8
Indiana	331	7.4	Rhode Island	24	6.4
Iowa	520	7.5	South Carolina	37	6.5
Kansas	263	7.8	South Dakota	504	8.0
Kentucky	138	7.2	Tennessee	81	6.9
Louisiana	100	7.4	Texas	219	7.8
Maine	40	6.8	Utah	240	7.8
Maryland	41	6.8	Vermont	55	7.0
Massachusetts	24	6.4	Virginia	76	7.1
Michigan	227	7.6	Washington	62	7.2
Minnesota	281	7.6	West Virginia	115	6.6
Mississippi	49	7.3	Wisconsin	256	7.5
Missouri	240	7.8	Wyoming	158	7.6
Montana	283	7.8			

Below 60 ppm, water is classified as aggressive; 61 to 120 ppm, soft; 121 to 180 ppm, hard; above 180 pm, very hard.

TABLE 3. WATER HEATER SELECTION CHART BASED ON TYPE WATER HEATED

Nature of Water Supply	Hardness Range	Required Water Temperature, Deg F	Recommended Types of Water Heaters	Remarks
Very Hard. Usually deep well ground water.	Above 180 ppm	120 - 140	Immersion type	No alternate recommendations are made although steam boilers with storage tanks can be used if heat exchanger coils are frequently cleaned of scale. This water too hard for other types of indirect heaters and vertical heaters with storage tanks scale rapidly.
		160 - 180	Immersion type with copper clad tubes	
Hard. Usually well water but some surface waters in softer range.	121 - 180 ppm	120 - 140	Immersion type Steam boiler and storage tank Vertical heaters and storage tank	This again is hard water and the long successful performance of immersion type heaters on such water makes them first choice. The use of vertical heaters and storage tanks should be restricted to the softer waters in the group. See comment above regarding steam boilers with storage tanks.
		160 - 180	Immersion type with copper clad tubes Steam boiler and storage tank	
Soft. Usually surface water including supplies taken from the Great Lakes. Waters in this group are frequently high in dissolved oxygen and include some soft corrosive waters.	61 - 120 ppm	120 - 140	Immersion type Immersion type with copper clad tubes Vertical heaters and storage tank Indirect heaters Instantaneous heaters	This looks like everything is recommended. It is in this hardness range, comprising the largest proportion of the nation's water supply, that the greatest difficulty in making specific recommendations is found. Refer to an analysis of the local water supply. Check the pH indication. Be especially careful in heating these waters to the higher temperatures. Dissolved oxygen is an important factor. Bear in mind that the softer waters included are frequently mildly corrosive. It is in heating these waters that local experience and manufacturers' recommendations should carry much weight.
		160 - 180	Indirect heaters Immersion type with copper clad tubes Multi-fin or coil type vertical heaters and storage tank Instantaneous heaters	
Aggressive water. Zeolite softened water. These include the low pH, extremely soft natural waters and the artificial softened hard waters.	Below 60 ppm	120 - 140	Indirect heaters Multi-fin, coil or Instantaneous heaters and special storage tank	With these waters—almost ideal for most purposes—corrosion is the greatest enemy. Growing awareness of the importance of safeguarding equipment against these corrosive effects has given impetus to the wide use of various types of indirect heaters. Zeolite-softened water is included in this bracket and refers to water softened on the premises by means of unit softeners.
		160 - 180	Steam boiler and special storage tank (classified as an indirect heater) Instantaneous heaters	

Table courtesy of Sellers Engineering Co., Chicago, Ill.

surfaces must be accessible for cleaning if long low cost service life is to be obtained. Removable steam coil heat exchangers become very useful because the limed coils can be lifted out of the tank or exchanger and scraped off. This may not be so easy if the lime becomes hard and tenacious.

Tubular boilers should not be used unless ample hand hole clean-outs are provided. Limed tubes lose their heat transfer capacity because of the insulating properties of the lime deposits. Burned out tubes result. Frequent acid cleaning becomes an advantageous means of maintaining efficiencies and capacities. Instantaneous or coil heaters must be avoided where liming can occur.

Selection by Distribution

Table 4 suggests a selection of hot water heating arrangements from the viewpoint of distribution of hot water demands. In this table the size of individual establishments is not considered but rather the relation between the components of the hot water heating system. Hot water heating need not be concentrated in a single heater from which long lines extend great distances. In order to avoid waste of water, return circulating lines must be laid out. Insulation and heat loss costs mount. Smaller unit heaters may be spread around in localized, concentrated areas. This decentralization produces flexibility, reduces gross investment and fuel costs, lowers down-time in case of failures, and gives better local service. Segregation of water heating equipment into use areas is particularly advantageous in factories, where the hot water for plating, washing and rinsing metal parts, plant restaurant and personnel washing facilities, may have different temperature or other requirements. Giving each area its separate hot water source generally saves in every way—water, fuel, maintenance, time and inconveniences. There is no need to maintain a supply of 180 deg metal cleaning and rinsing water for personnel washrooms that can more safely use water at 120 to 140 deg. Flexibility should be the key to the complete hot water system. There are so many types of heaters, fuels, boosters and exchangers available today that the hot water supply can be tied to each operation or process, or to each family unit. Individual demands can be met regardless of adjacent heavy demands if the supply is tailored to meet requirements and loads.

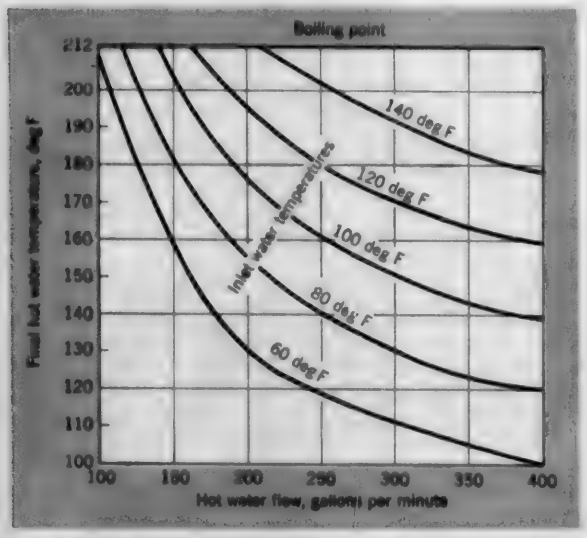


Fig. 2. Final temperatures from multi-coil (instantaneous) water heaters based upon a capacity of 250 gpm for a 60 deg temperature rise.

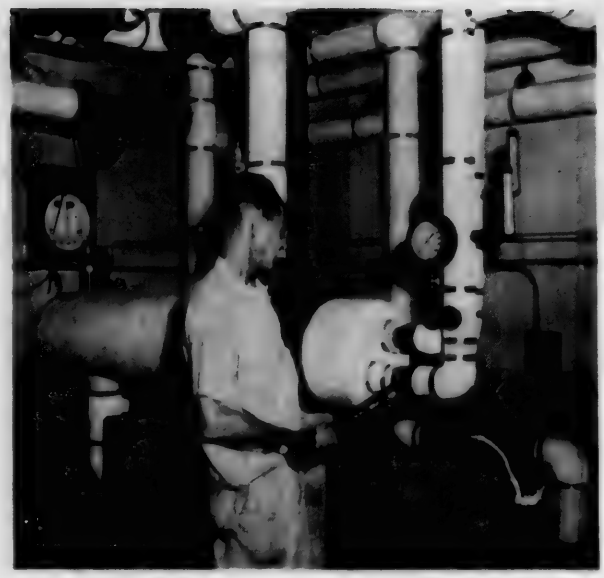


Fig. 3. Example of a compact heat exchanger using high pressure high temperature hot water as the heating fluid. Courtesy, Combustion Engineering, Inc.

Sources of Supply

A brief outline of some of the more common sources of hot water supply will set forth their main characteristics and limitations:

Standard directly heated automatic storage heaters. In this category are placed the simple gas or propane-fired, or electrically heated storage tank heaters used so universally in homes, apartments, smaller institutions or establishments. Sizes range from 15 to 100-gallon storage capacity normally, with 25 to 98 gal per hr recovery with a 60 deg temperature rise. Heat input normally ranges from 10 to 70 thousand Btu per hr. Different manufacturers set their individual heat input ratings for various sizes of heaters and types of fuel. In some areas off-peak current is utilized in electric storage hot water heaters. These reduced rates lower costs but sufficient hot water storage capacity must be installed to last during the non-heating hours of the day. In commercial and industrial plants that carry demand electric rates, hot water supplies can be built up during off-peak hours with good economy, if the peak billing demand can be shaved off or kept at a minimum.

These automatic storage heaters are highly efficient if sized properly. They are simple, inexpensive in installation, piping and controls, and very trouble-free. They serve well with all kinds of water, hard or soft, alkaline or acid. They can be drained and cleaned readily, especially if flush-out hand-holes are provided. They can be procured with corrosion resisting metal tanks, glass-lined or galvanized tanks shaped to harmonize with the environment, and placed anywhere. A large central heater can be installed for an entire establishment, or small individual units can be spread at will for local hot water

TABLE 4. SELECTION OF WATER HEATERS BASED ON USAGE

Application	Type of Load	Type of Water Heater	
		Storage Capacity	Heat Input or Pick-up Capacity
Hotels	Intermittent heavy loads at meal and personal wash hours	Very large	Large, for heavy demands
Loft and office buildings Warehouses	Very intermittent, long waits between uses	Instantaneous type of heaters located near points of use. None	Full capacity
Apartments	Intermittent concentration, meal and personal wash hours	Large	Light
Hospitals	High load factors, fairly constant use	Large	Medium
Commercial Restaurants Laundries	High load factors, constant use	Large	Large
Manufacturing	High load factor, constant use	Light	Large

supply. They are generally low-demand heaters, with low Btu input so that the heating of the water is spread over several hours.

Instantaneous multi-coil water heaters, direct fired. Instantaneous types of water heaters must have sufficient output capacity to fill all demands simultaneously, unless allowance is made for normal maximum load diversity, such as 75% of the summation of all individual unit capacities. These heaters have no built-in storage volume because they are designed to supply the full load instantly and continuously. The flow of the fuel, gas or liquid, is automatically controlled by the flow of water in an on-and-off or a modulated flow system. The water flow rate, temperature and heat input are fixed at the factory. Heat input must be high in order to insure the flow of hot water. Efficiencies, because of these high flow rates and generally on-and-off operation, are lower than the storage types.

Capacities run roughly from 1.5 to 10 gal per minute (90 to 600 gal per hr for a 60 deg rise in water temperature). Heat input rates run from 150 to 200 thousand Btu per hr approximately.

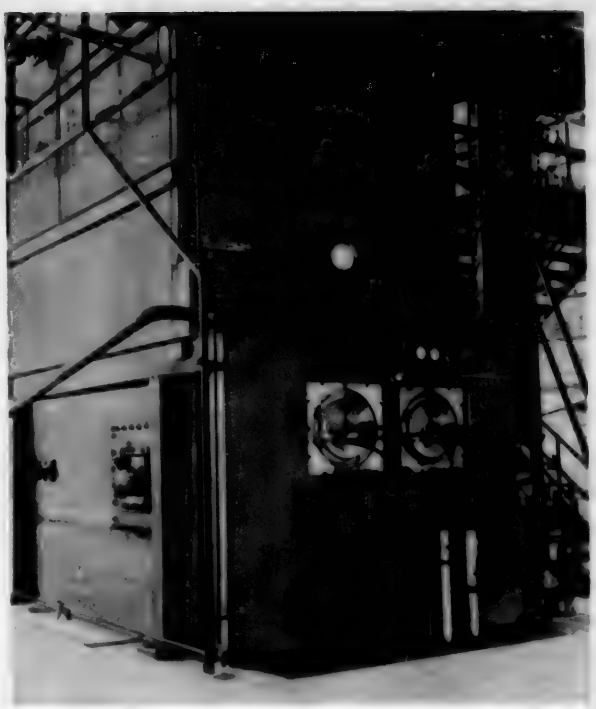


Fig. 4. High pressure high temperature hot water boiler designed for 400 psig. Courtesy, Combusion Engineering, Inc.

These multi-coil, high capacity heaters can be used as boosters taking the normal supply of hot water of about 140 deg and raising its temperature quickly to that set for the given flow of water. Curves of Fig. 2 illustrate the temperature rise obtainable for various settings of flow through a multi-coil heater rated at 250 gal per hr capacity with a 60 deg rise in temperature. Other conditions are assumed constant. Final temperatures are shown for various inlet water temperatures and flows.

Instantaneous heaters have advantages over storage types where the usage of hot water is very intermittent, and where it may be more expensive to install, insulate

TABLE 5. THERMAL PROPERTIES OF WATER—212 TO 400 DEG F

Temp., Degrees F	Pressure, psia	Density, lb per cu ft	Specific Volume, cu ft per lb	Specific Heat	Total Heat			Heat Ratio, Water: Steam
					Water, Btu per lb	Water, Btu per lb	Steam, Btu per cu ft	
212	14.70	59.88	0.01671	1.0055	180.07	10,760	42.90	251.0
220	17.19	59.66	0.01677	1.0068	188.13	11,222	44.65	224.0
230	20.77	59.37	0.01684	1.0087	198.23	11,764	58.05	201.0
240	24.97	59.17	0.01693	1.0104	208.34	12,327	66.50	185.5
250	29.81	58.84	0.01700	1.0126	218.48	12,856	88.00	145.0
260	35.42	58.62	0.01708	1.0148	228.64	13,403	106.00	126.0
270	41.85	58.25	0.01717	1.0174	238.84	13,912	126.00	110.0
280	49.18	58.04	0.01726	1.0200	249.06	14,555	146.50	99.0
290	57.55	57.65	0.01736	1.0230	259.31	14,942	166.00	90.0
300	67.00	57.41	0.01750	1.0260	269.59	15,476	186.00	82.0
310	77.67	57.00	0.01760	1.0296	272.92	15,955	224.00	74.0
320	89.63	56.65	0.01770	1.0332	290.28	16,444	258.00	58.5
330	103.00	56.31	0.01780	1.0368	300.68	16,931	290.00	55.6
340	118.00	55.95	0.01790	1.0404	311.13	17,407	324.00	52.5
350	134.60	55.65	0.01800	1.0440	321.63	17,899	358.00	49.0
360	153.00	55.19	0.01810	1.0486	332.18	18,333	401.00	45.5
370	173.30	54.78	0.01820	1.0532	342.79	18,778	454.00	41.5
380	195.60	54.36	0.01830	1.0578	353.45	19,213	510.00	37.7
390	220.20	53.96	0.01840	1.0624	364.17	19,644	570.00	34.8
400	247.10	53.62	0.01850	1.0670	374.97	20,106	630.00	31.5

Table by Owen S. Lieberg, Air Conditioning, Heating and Ventilating, Sept., 1955.

TABLE 6. HOURLY USE OF HOT WATER BY AVERAGE FAMILIES

Hour	Equivalent Number of Persons in Family			
	2	4	5	6
	Hot Water Used, Gal per Hr			
6 a.m.	0	0	0	0
7	5	5	7	8
8	2	6	5	8
9	4	12	7	18
10	3	7	5	8
11	3	3	5	7
12 Noon	2	2	4	4
1 p.m.	3	3	5	5
2	8	8	8	8
3	0	0	8	8
4	0	0	2	3
5	1	1	3	4
6	2	2	3	4
7	2	2	4	6
8	8	8	10	16
9	0	6	8	0
10	2	2	4	5
Total gal per day	45	67	88	112

TABLE 7. AVERAGE AMOUNT OF HOT WATER NEEDED BY AVERAGE FAMILY

No. of Persons in Family	Gallons Hot Water Used by Family in Maximum Day
2	45
3	60
4	75
5	90
6	105
7	120
8	135
9	150
10	165

and maintain storage tanks and circulating lines, full of hot water. A small automatic instantaneous heater located at the point of consumption could provide a simple inexpensive source of hot water for an isolated need. Such installations occur in loft buildings, warehouses and shops.

Booster heaters. The term "booster" is applied to the purpose or function of the water heater. Heaters may be ordinary standard types, but they serve to raise the temperature of the regular hot water supply to some higher temperature needed to perform special functions. The advantages in the use of booster heaters are:

1. Only as much water need be heated to abnormally high temperatures as is required for the particular job. The larger normal uses throughout the building can use average hot water at lower temperatures.
2. Savings in investment, maintenance and operating costs are derived from the limited use of very hot water.
3. Small boosters may be located near its job, with simple control, minimum waste and smoothest operation.

Heat exchangers. Heat exchangers are simple devises wherein a hot flowing fluid gives up heat by direct conduction in passing a cooler fluid flowing in adjacent piping or compartments. Figure 3 shows an insulated heat exchanger that uses very high temperature water as its heating medium. Generally steam performs this job. Frequently hot waste fluids such as water, oil or exhaust steam are utilized.

Steam coils. Steam coils are given separate mention because of the wide use of all types of steam coils in heating water in storage tanks, pipe coils in industrial cleaning, rinsing, plating and coating of metals; coil radiators in heating larger equipment; and in the convenience of steam where central plant steam is available for local hot water needs. Removable steam coils are frequently used for hard water tank heaters because of the ease of removal of the coils for cleaning. Package steam coil tank heating systems are readily available in all sizes. Steam heat exchangers are available for use as instantaneous hot water heaters, similar in function to the direct fired multi-coil heaters. Control systems, with diaphragm, sylphon or electric types of valves and equipment, make the steam heated hot water supply fully automatic, economical and ideal for many uses.

Special methods. There are many special methods of heating water and solutions, either improvised or available. Many shops devise methods that fit their particular conditions. They may use gas burners under tanks, firing directly against the metal bottom or sides; side arm coil heaters mounted on tanks for circulatory heating; immersion coils and tubes into which gas firing is directed; submerged gas burners that fire directly into the water or solution, the hot products of combustion bubbling through the liquid to be heated; electric immersion heaters or resistance elements.

High pressure high temperature hot water. A discussion of hot water would be incomplete without the inclusion of superheated water. In a closed system water can be heated under higher pressures to temperatures well above the boiling point, commonly as high as 400 deg with pressures up to 235 psig. The chief advantage is the high heat content of water compared to steam as listed in Table 5. The incompressibility of water makes pumping hot water long distances a simple venture. The large quantity of hot water in the supply lines and the residual

TABLE 8. BREAK-DOWN OF HOT WATER CONSUMPTION FOR A FAMILY OF 4 PERSONS

Item	Gallons per Operation	No. of Operations per Week	Gallons Hot Water per Week
Tub bath (or shower)	12	16	192
Dish washing, ¾ gal per person	3	21	63
Laundry	18	3	54
Miscl. cleaning per week	30	1	30
Personal shaving and toilet, 1 gal per person	4	7	28
			Total 367
Average per day	52 gallons		

Table by E. A. Cliffort, National L-P Gas Institute, published in LP-Gas, November, 1950.

TABLE 9. UNIT BASES FOR HOT WATER ESTIMATES

Basic Unit	Unit Consumption
Office help	2 gal per person per 24 hours
Factory help	5 gal per person per 24 hours
Hospitals	80 gal per bed, average day of 24 hours
Hospitals	125 gal per bed, maximum day of 24 hours
General building cleaning	30 gal per 10,000 sq ft surface washed
Car washing	50 gal per car

heat in the return circuit form a thermal flywheel that evens out the heat demands of individual heat consuming units. Figure 4 illustrates a high pressure high temperature hot water heater designed for 400 psig but operated at 275 psig and 415 deg, with a heat input rate of 50 million Btu per hr. This takes us to the big end of the scale of sizes of hot water heaters.

Indirect water heaters. There is a high temperature heat exchange type of water heater, wherein the high temperature water is heated directly to 220 deg in a tubular boiler. The high temperature water passes into a large tank or reservoir in which are suspended two copper coils. The heat absorbing capacity of the two coils is about 5 times the heat input capacity of the gas burners. The large heating hot water supply in the boiler and tank is very high, and provide a heat storage for heavy demands. This provides a fly-wheel effect, to carry over the heavy demand period without loss of temperature.

This type heater can supply water of two different temperatures. The outlet of the helical coil will feed water at 140 deg. If the right valve is used, a second coil, in series with the helical 140 deg coil, comes into operation and 180 deg water is drawn, the extra loop having additional heat exchange capacity. These dual temperature arrangements are very useful in restaurants, hotels, laundries, hospitals, and in industrial plants where sterilizing 180 deg water is needed, beyond the normal 140 deg water used for ordinary purposes. Input heat capacities for 4 sizes available, range from 240,000 to 720,000 Btu per hr.

HOT WATER DATA

Hot water used in apartments, hotels and dwelling areas is chiefly for personal needs and Table 6 gives some basic data on the hot water requirements of average families. It must be remembered that these values may vary in large dwelling areas from the lower income groups found in older tenement buildings with limited facilities, through the gamut of public or private housing, to the expensive apartment hotels with unlimited quantities of hot water available throughout the family unit. Tests run in Dayton on some large median apartment buildings indicated a base average of 50 gal per family per day—or 50 gal per apartment per day.

As an idea of the wide variation in family consumptions, Tables 6, 7, 8 and 9 based upon American Gas Association studies made in 1951, give the maximum hourly demands for different sizes and types of families. The association estimates that a tub bath averages about 15 gal, shower bath 3 gal per minute each, regular washers 12 gal per load, automatic washers 18 gal per load, hand dishwashing 3 gal per meal, automatic dish washers 7 gal per load.

Each additional bathroom, automatic dish or clothes washer, or other major hot water appliance is about the equivalent of adding another person. Four persons living in a dwelling unit of six rooms with 2 baths, provided with an automatic dish and clothes washer, could be the equivalent load in hot water requirements as seven persons.

It might be well to look into the hot water demands of some of these families as a portrait of the hourly variations throughout the average maximum day of usage. As a result of some tests run, the following tabulation is useful in understanding the fly-wheel effects of storage hot water capacity in order to carry over the heavy load periods, such as occur at meal times, washing clothes at 9 a.m., cleaning up evening dishes at 8 p.m., and so on. These four withdrawal records were taken at random on typical maximum days.

Table 10 lists the recovery powers of hot water heaters for different heat input rates and water temperature rises, as a guide to meeting family demands such as listed in Table 6.

TABLE 10. HOT WATER RECOVERY IN HOT WATER HEATERS OF VARIOUS BTU PER HOUR INPUT RATINGS

Rate of Btu Input per Hour	Temperature Rise, Deg F							
	40	50	60	70	80	90	100	110
	Gallons per Hour Recovery							
2,500	5.6	4.5	3.7	3.2	2.8	2.5	2.3	2.0
4,500	10.0	8.1	6.8	5.8	5.1	4.5	4.1	3.7
6,500	14.6	11.7	9.8	8.4	7.3	6.5	5.8	5.3
9,000	20.3	16.2	13.5	11.6	10.1	9.0	8.1	7.4
10,000	22.6	18.0	15.0	12.9	11.3	10.0	9.0	8.2
12,000	27.0	21.6	18.0	15.4	13.5	12.0	10.8	9.8
15,000	33.8	27.0	22.5	19.3	16.9	15.0	13.5	12.3
18,000	40.5	32.4	27.0	23.2	20.3	18.0	16.2	14.7
20,000	45.0	36.0	30.0	25.7	22.6	20.0	18.1	16.4
25,000	56.3	45.0	37.5	32.2	28.1	25.0	22.5	20.5
30,000	67.5	54.1	45.0	38.6	33.7	30.0	27.0	24.6
50,000	112.6	90.0	75.0	64.4	56.2	50.0	45.0	41.0
75,000	169.0	135.0	112.5	96.5	84.5	75.0	66.5	61.5
100,000	225.3	180.0	150.0	128.8	112.4	100.0	90.0	82.0

Thermal efficiency is assumed to be 75%. Other efficiencies will produce proportional hourly recoveries.

TABLE 11. FACTORY HOT WATER DATA

Fixtures	Number of Units	Hourly Unit Demand, gph	Total Demand, gph
Slop sinks	4	20	80
Wash basins			
Private	6	3	18
Public	20	15	300
Showers	6	200	1,000
Wash racks	4	30	120
Total	40	268	1,518

Consumption and Weather

In the beginning of this discussion mention was made that many factors are involved in any such basic average. Hot weather increases hot water consumption, as pointed out in the map showing weather distribution throughout the U. S. Tables 7, 8 and 9 were designed for estimating purposes to illustrate the variation in hot water consumption. Possible adjustment that might be made for weather conditions can be indicated with Fig. 1.

These variations are included in this discussion not to confuse the reader with complexities, but rather to indicate the factors that can be used in making more accurate estimates of basic requirements. They lessen the need for a large safety factor. Table 9 lists some quick basic figures compiled from various sources for the purpose of estimating hot water consumptions in commercial buildings in terms of personnel or units. These figures can serve as checks on other estimates made by more accurate measurements or other more direct means. The American Gas Association in its program of Sizing by Science has pub-

TABLE 12. BASIC DATA ON HOT WATER REQUIREMENTS FOR A FAMILY UNIT

Number of People in the Family	Number of Bathrooms	Dish-washing Equipment	Laun-dry Equipment	Maximum Gal Hot Water Needed per Hour	Maximum Size Water-heater to Provide Maximum Hot Water Requirement	
					Tank Capacity, Gal	Heat Capacity, Btu per Hr
2	1	Sink	None	25	30	20,000
2	1	Sink	Tubs	30	30	20,000
3	1	Sink	Tubs	35	30	20,000
3	1	Sink	Washer	40	30	20,000
4	1	Sink	Washer	45	40	20,000
4	1	Sink	Auto. washer	50	40	25,000
5	2	Sink	Tubs	55	45	25,000
5	2	Sink	Washer	60	45	30,000
6	2	Sink	Auto. washer	70	50	35,000
6	3	Sink	Auto. washer	70	50	50,000
7	3	Sink	Auto. washer	90	60	50,000
7	4	Auto. washer	Auto. washer	100	75	50,000

lished (1951) some basic data on family hot water needs for use with dwelling units. They estimate that as much as 80% of all the gallons of water used by a family is "hot", because of the increased use of mechanical washing and personal use, listing as many as 136 uses for hot water in the home. Table 12 presents these AGA data, forming the most complete basic data available for dwelling unit estimates.

A composite of all of the basic data is given in Table 13, as an average of the unit hourly demands for hot water by the various appliances as used in commercial and industrial establishments. This table gives a good detailed coverage for many types of buildings and applications. The two columns at the right of this table estimate the percent of installed heater and storage capacity that would be consumed per hour by the appliances for each type of installation. As an example, a factory having 4 slop sinks, 6 private and 20 public wash basins, 6 showers and 4 wash racks would have requirements listed in Table 11.

The hot water heater capacity for this factory would be 90% of the total hourly demand of 1,518 gal or 1,367 gal. The hot water storage capacity needed figures 50% of the total demand for all fixtures, for an industrial plant, or 760 gal. This storage tank, from Table 14, would probably be 48 inches diameter by 120 inches long. Table 14 presents useful data on cylindrical hot water storage

TABLE 13. HOURLY AVERAGE DEMANDS FOR HOT WATER FOR EQUIPMENT IN COMMERCIAL AND INDUSTRIAL BUILDINGS. WATER TEMPERATURE 180 DEG F

Type of Building	Dish Washer	Pantry Sink	Kitchen Sink	Slop Sink	Wash Basin, Private	Wash Basin, Public	Bath Tub	Shower Bath	Foot Basin	Laundry Tub, Stationary	Laundry Tub, Revolving	Wash Racks	Per Cent of Heater Capacity	Per Cent of Storage Capacity
	Maximum Gallons per Hour per Appliance or Fixture													
Apartment house	15	10	10	20	3	5	15	50	3	25	75	30	20	100
Church	30	20	20	10	3	5	—	100	—	—	—	—	80	50
Club	30	20	20	20	3	8	15	200	3	35	75	—	50	75
Department store	—	—	—	20	3	8	—	—	—	—	—	—	50	75
Depot	—	—	—	20	3	10	—	100	—	—	—	—	60	50
Dormitory	—	—	—	15	3	10	30	200	3	35	100	—	75	50
Garage	—	—	—	—	3	12	—	150	—	—	—	50	80	50
Gymnasium	—	—	—	—	3	10	30	200	12	—	—	—	80	50
Hospital	30	20	20	20	3	8	15	50	3	35	125	—	60	50
Hotel	30	20	20	30	3	10	15	50	3	35	150	—	50	25
Industrial plant	30	—	20	20	3	15	30	200	12	—	—	—	90	50
Laundry	—	—	—	10	3	10	—	—	—	40	150	30	100	25
Loft bldg.	—	—	—	20	3	10	—	150	—	—	—	—	80	50
Office bldg.	—	—	—	15	3	8	—	—	—	—	—	—	15	100
Public bath	—	—	—	15	3	15	45	200	—	—	100	—	100	50
Residence	—	10	10	15	3	—	15	50	3	25	75	—	50	100
Restaurant	300 gallons per 500 people per hour												50	75
School	15	20	10	20	3	18	—	200	—	—	—	—	25	50
Theater	—	—	—	15	3	5	—	—	—	—	—	—	75	75

tanks, capacities, dimensions, outside surface areas and normal heat loss from these tanks if uninsulated, with the hot water temperatures about 140 deg.

It can be noted that some of these tables as well as other data, are tied to specific temperatures. It has been mentioned that in general the volume of hot water used by individuals varies in an inverse proportion to the temperature of the water. Corrections should be made for the larger quantities of hot water that would be used at lower water temperatures. These temperature-quantity corrections would correspond to the capacity curves of multi-coil heaters discussed under Methods of Heating Water using the curves of Fig. 2 for correction values. This will be discussed later under the subject of mixing water.

Sizing Pipe

Having determined the quantity of hot water needed by the various families and appliances and the heater and tank sizes and capacities, the big job is to get the water from the heaters to the appliances and fixtures. The piping lay-out is one of the important and at the same time difficult steps in the design of the hot water system. There are a number of factors that can decrease the pipe sizes and thus the cost of material and labor.

For purposes of piping design, sizing and lay-out to the water-using units, Table 15 presents the water discharge capacities of fixtures and appliances, for various rates of flow in terms of gallons per minute. Table 16 continues these flow data, giving the flow expected through various lengths of pipe for types of pipe commonly used, based upon suitable drops of pressure that can be safely used. Pressure drops that are safe depend upon the main pressure, because 30 psi is ample pressure at any appliance. If the water pressure entering the property is 75 psi, the pipe might be figured on an allowable drop of 45 psi. Local practices, codes or engineering standards will dictate desirable appliance pressures and pressure drops to be used in figuring piping sizes.

TABLE 14. DATA ON CYLINDRICAL HOT WATER STORAGE TANKS

Diameter, Inches	Length, Inches	Capacity, Gallons	Outside Surface, Sq Ft	External Heat Radiation Loss, Btu per Hour
12	36	18	11.0	1540
12	48	24	14.3	2002
12	60	30	17.5	2450
14	48	32	17.0	2380
14	60	40	20.8	2911
16	48	42	19.8	2772
16	60	52	23.8	3346
18	60	66	27.5	3850
20	60	82	31.0	4340
22	60	100	34.6	4839
24	60	120	38.3	5360
24	72	144	44.6	6240
24	96	192	57.1	7990
30	72	220	62.0	8700
30	96	294	82.0	11500
30	120	367	98.0	14000
36	72	318	87.0	11400
36	96	423	115.0	16300
36	120	529	140.0	19800
42	96	576	150.0	21200
42	120	720	185.0	26500
42	144	864	225.0	32500
48	96	564	148.0	20800
48	120	752	192.0	27500
48	144	940	245.0	35500

TABLE 15. WATER DISCHARGE CAPACITIES OF COMMON APPLIANCES AND FIXTURES

Appliance	Gallons per Minute for Various Rates of Flow		
	Light Flow	Medium Flow	Heavy Flow
Washroom lavatory	0.5	1.5	3.0
Bathroom lavatory	2.0	3.0	4.0
Shampoo spray	0.5	1.0	2.0
Manicure tables	1.0	1.5	2.0
Bath tub	3.0	4.0	5.0
Shower, 4 in. head	3.0	4.0	5.0
5 in. head	6.0	7.0	8.5
6 in. head	8.0	9.0	10.0
8 in. tubular head	10.0	13.0	16.0
needle	20.0	30.0	40.0
Sinks, slop	4.0	5.0	6.0
kitchen, ½ in.	1.0	2.0	3.0
kitchen, ¾ in.	3.0	4.0	5.0
Dishwasher, hand	—	5.0	—
machine	—	25.0	—
Laundry tub, stationary	4.0	5.0	6.0
revolving	—	25.0	—

Diversity Factors

Not all appliances or fixtures operate at the same time. All faucets are not turned on simultaneously, fortunately. In determining demands or flows for buildings having a number of apartments, operating units, kitchens, washing or laundering facilities, divsersity factors must be used in order to avoid over-estimation of flows and over-sized piping.

Elbows, fittings, valves, and other installed impedimenta must be converted into straight length of pipe for the given size and added to the measured straight lengths. These fittings produce a change in direction and a corresponding resistance to the flow. Copper and plastic tubing use long angle bends with practically no loss in pressure or resistance to smooth flow. Flows through straight pipe lengths are given in Table 16. In Table 17, the nominal designated diameter is used under "fittings." The conversion multiplying factor gives the equivalent straight length in feet of the same size pipe for each fitting in the system, of its nomenclature.

The distance of the various fixtures or faucets from the source of hot water affects the rate of flow in large hotels, apartment houses, office or factory buildings. The increased resistance of the piping and fittings produces a drop in the pressure at the fixture; the greater the number of fixtures that might come on at the same time, the larger the pressure reduction ahead of the faucets or valves. This may reduce the drop across these valves or faucets below the design drop of 3 psi required to meet the designated flow for these fittings. The actual flow falls below those listed for the various appliances and, therefore, a diversity correction could be made when sizing the pipe.

Experience has developed the relative expected discharges of fixtures and the total flow of hot water in the system. Diversity or mutiplication factors are applied to the separate or total unit design capacities in order to derive actual discharges for a multiplicity of units installed on any floor or in a given area. Table 18 gives this experience in diversity flow or factors for up to 24 fixtures on one floor.

In addition to the diversity factor for many appliances on one floor, we must consider group diversities among

TABLE 16. FLOW OF WATER THROUGH PIPE*

Type of Pipe and its Nominal Size		Pressure Drop, psi	Length of Straight Pipe in Feet					
			20	30	50	70	100	150
Type	Size, In.		Flow in Gallons per Minute					
Copper tube	¼	30	6.0	4.9	3.8	3.2	2.7	2.2
		40	6.9	5.7	4.4	3.7	3.1	2.5
		50	7.7	6.3	4.9	4.1	3.5	2.8
		75	9.5	7.7	6.0	5.1	4.2	3.5
Copper tube or steel galv. pipe	⅜	30	11.9	9.7	7.5	6.4	5.3	4.4
		40	13.8	11.2	8.7	7.4	6.1	5.0
		50	15.4	12.6	9.7	8.2	6.9	5.6
		75	18.9	15.4	11.9	10.1	8.4	6.9
Brass or galv. steel pipe	½	10	12.4	10.1	7.8	6.6	5.6	4.5
		20	17.5	14.3	11.1	9.4	7.8	6.4
		30	21.5	17.5	13.6	11.5	9.6	7.8
		40	24.8	20.3	16.1	13.3	11.1	9.1
		50	27.7	22.6	17.5	14.8	12.4	10.1
		75	34.0	27.7	21.5	18.2	15.2	12.4
Galv. steel pipe	¾	10	24.7	20.1	15.6	13.2	11.0	9.0
		20	35.0	28.5	22.1	18.6	15.6	12.8
		30	42.7	35.0	27.1	22.7	19.1	15.6
		40	49.2	40.4	31.2	26.4	22.1	17.9
		50	55.3	45.1	35.7	29.4	24.7	20.1
		75	67.6	55.3	42.8	36.2	30.2	24.7
Galv. steel pipe	1	10	45.2	37.0	28.6	24.2	20.2	16.5
		20	64.0	52.2	40.5	34.2	28.6	23.4
		30	78.4	64.0	49.5	41.9	35.0	28.6
		40	90.5	73.9	57.2	48.4	40.5	33.0
		50	101.2	82.6	64.0	54.1	45.2	36.9
		75	123.9	101.1	78.4	66.2	55.4	45.2
Galv. steel pipe	1¼	10	60.4	49.4	38.2	32.3	27.0	22.6
		20	85.0	70.8	54.8	45.5	38.0	31.3
		30	105.2	85.9	66.5	56.3	47.0	38.4
		40	120.8	98.8	76.4	64.7	54.0	44.1
		50	136.3	111.5	86.2	73.9	60.9	49.7
		75	167.0	136.5	105.6	89.4	74.6	60.9
Galv. steel pipe	2	10	197.0	161.1	124.5	105.4	88.0	71.9
		20	279.8	228.7	176.8	149.7	125.0	102.2
		30	342.3	280.0	216.4	183.3	153.0	125.0
		40	393.7	312.0	249.0	210.9	176.0	143.8
		50	441.1	360.9	279.1	236.2	197.3	161.2
		75	541.0	442.3	342.2	289.5	241.8	197.5

*Industrial Gas, October, 1954.

the several floors of buildings. The sources of the hot water may be the service main entering the building basement below the street level, or it may be a water tank on the top of the building. Each additional floor increases the diversity about 10% of the previously considered floor. This is of importance in laying out the main feeder piping.

The diversity data in Tables 18 and 19 were developed by the American Gas Association, for hot water supplied from a normal basement storage tank. With circulating lines feeding hot water to these floors continuously in order to keep hot water on tap, supply may be taken from the returning down leg of the loop rather than from the riser header, as may be selected by the designer in his most economical lay-out. In some large multi-floor buildings, the hot water storage tank may be located on the top floor close to the building's cold water tank or reservoir, if such a tank or standpipe system is used in the building.

Table 18 gives a set of multiplication factors for num-

TABLE 17. FITTING CONVERSION FACTORS INTO STRAIGHT PIPE LENGTHS†

Fitting	Multiplying Factor
90 deg long sweep elbow	1
90 deg standard elbow	2
45 deg standard elbow	1
Tee fitting, standard	2 to 4*
Reducing coupling	2 to 4**
Gate valve	1
Globe valve	2
Tank outlet	4***

*The larger value is used when flow enters tee from side outlet, hitting a solid wall. Smaller values used for flow from end out of side outlet, practically a 90 deg elbow motion.
**The larger value is used where reduction is large.
***Diameters of pipe connections from tank outlets.
†Plumbers and Heating Contractors' Trade Journal, June 15, 1930.

TABLE 18. DIVERSITY FACTORS FOR FIXTURES ON ANY FLOOR OR IN ANY CLOSE GROUP*

Number of Fixtures Within the Group	Multiplication or Diversity Factor
1	1
2	2
4	3.3
8	5.5
12	7.5
16	9.5
20	11.5
24	13.0

*Industrial Gas Series, Hot Water, American Gas Association.

bers of fixtures located on any floor of an office, hotel, apartment house, loft or other type of commercial or factory building. These factors represent the probability of all of the fixtures being used at the same time to create the demand. The greater the number of similar fixtures and uses, the lower their total proportional normal demand will become. Multiply the demand of a single fixture of a group of similar types or functions, as are listed in Table 15 or as may be obtained by tests or specifications of the equipment used, by the factor for the number of these fixtures on the floor or in any concentrated group of a manufacturing plant. Similar basic units such as hotel rooms, production metal cleaning or plating groups can be used for the application of the diversity and "normal" demand determinations. Interpolation of the values in the table can be used should the number of units exceed the limit of Table 18. Corroborative tests can always be made by actually metering the hot water to initial groups, where this can be done.

Where a single pipe line or source feeds hot water to a number of floors or groups, each of which has many fixtures or units, consideration of an additional diversity among these groups may provide further economies of installation, in terms of main or header sizes, with their weights, handling and labor of installation. Table 19 illustrates the use of diversity among floors of a 12-story building. It is based upon a standard floor or unit demand of 100 gpm, supplied from the top of the building. Without the use of any diversity factors among the floors, the feeding main must supply 100 gpm at the ground floor level, 200 gpm entering the second floor, 300 gpm at the third floor, and so on until the piping at the top or twelfth floor, would have to be sized for a total 1200 gpm flow.

The tabulation, Table 19, gives the diversity on the ground floor, with a total of all unit demands of 100 gpm net flow at 60% or 60 gpm. A 2½ in. feeder is figured for this supply. For the bottom two floors combined, 200 gpm, the diversity factor drops a little to 0.54 or 108 gpm, needing only a 3 in. supply line for both floors. After the 8th floor there is no further decrease in the diversity, and it is now stationary at 24% of the sum of all of the demand fed up to this level. The last column denotes the size of hot water main that should handle all of the hot water requirements of all of the floors.

The purpose served by these diversity tables is to present factors that have been derived by experience, which are helpful in hot water computations. They are based greatly upon the basic work done by the American Gas Association. Table 4 suggests the types of loads and the intermittency of use in the more common types of hot water uses in larger establishments. It might be well, where deemed advisable, to adjust diversity and other factors to meet local conditions, as judged by actual study, tests or observation of projects similar to those under consideration.

TABLE 19. FLOOR OR GROUP DIVERSITY FACTORS FOR A GIVEN 12-STORY BUILDING SUPPLIED FROM THE TOP OF THE BUILDING*

Floor	Diversity Factor	Flow for Determining Pipe Sizes Gal per Min	Dia. of Hot Water Riser, Inches
Top	0.24	288	4
11	0.24	264	4
10	0.24	240	4
9	0.24	216	4
8	0.24	192	3½
7	0.26	182	3½
6	0.30	180	3½
5	0.36	180	3½
4	0.42	168	3½
3	0.48	144	3½
2	0.54	108	3
Ground	0.60	60	2½

*Industrial Gas Series, Hot Water, American Gas Association.

TABLE 20. AVERAGE MONTHLY WATER TEMPERATURE, NEW YORK CITY*

Month	Cold Water Temperature, Deg F
January	40.5
February	39.0
March	40.5
April	47.5
May	55.5
June	63.0
July	69.0
August	71.0
September	70.0
October	64.0
November	54.5
December	44.5

*A. M. Apman, Consolidated Gas Co., Gas Age, May 5, 1928.

TABLE 21. MAXIMUM LENGTHS OF HOT WATER LINES THAT MAY BE INSTALLED WITHOUT CIRCULATING LINES

Pipe Size, Inches	Maximum Length of Pipe, Ft	Ft of Pipe Containing One Gal Hot Water	Gallons in Pipe Length Given in Col. 2
½	150	63.2	2.4
¾	90	36.1	2.5
1	50	22.3	2.3
1¼	30	12.8	2.4
1½	23	9.4	2.4

Larger pipe sizes installed vertically or without too many bends or frictional flow resistance, may generate natural circulation within the pipe.

TABLE 22. HEAT LOSS FROM BARE PIPE SURFACES

Pipe Dia., Inches	Heat Loss per Lineal Foot of Pipe, Btu per Hour	
	Steel Pipe	Copper or Brass
½	86.4	52.8
¾	105.6	69.6
1	132.0	88.8
1¼	163.2	105.6
1½	182.4	122.4
2	216.0	156.0
2½	266.4	187.2
3	316.8	218.4
4	408.0	278.8

TABLE 23. SURFACE AREA AND VOLUME OF PIPE

Size of Pipe, Inches	Length of Pipe, Feet, that Holds 1 Gal Water	Length of Pipe, Feet, to Give 1 Sq Ft External Surface
⅜	100.8	5.66
½	63.2	4.55
¾	36.1	3.64
1	22.3	2.90
1¼	12.8	2.30
1½	9.4	2.01

EFFECTS OF WATER TEMPERATURES

Since the hot water capacities of equipment, operations, and consumptions are based upon a 60 deg, 80 deg or other temperature rise, a variation in temperature conditions may greatly affect results. In figuring large volume hot water needs, the varations in the temperature of the inlet cold water may require consideration. As an example, the average monthly temperature of the water supply of New York City, Table 20, shows quite a wide variation. The maximum variation is 71-39 or 32 deg.

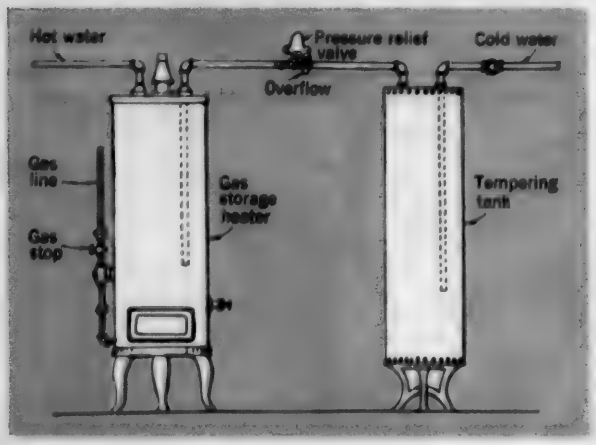


Fig. 5. Tempering tank placed ahead of the regular hot water heater to handle abnormally cold water.

TABLE 24. VENT LENGTHS FOR BUILDING HEIGHTS*

Building Height, Feet	Height from Tank Water Level to Discharge, Feet
100	3.5
200	7.0
300	10.5
400	14.0

*Pittsburgh Water Heater Manual, Pittsburgh Water Heater Corp., Pittsburgh, Pa.

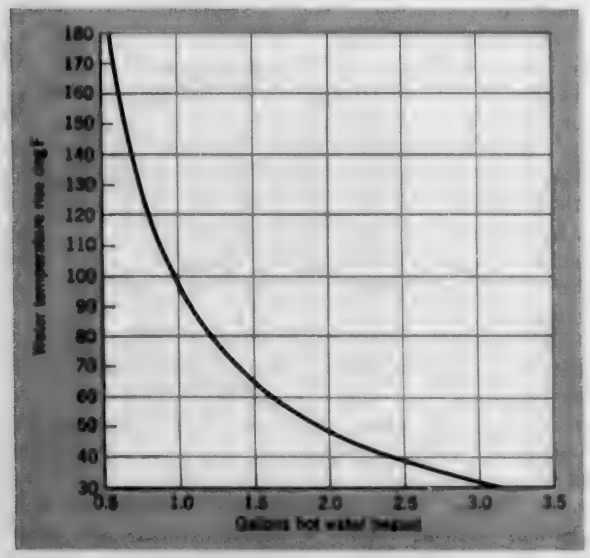


Fig. 6. Gallons of water heated by 100 cu ft of natural gas of 1000 Btu 80% thermal efficiency for various water temperature rises.

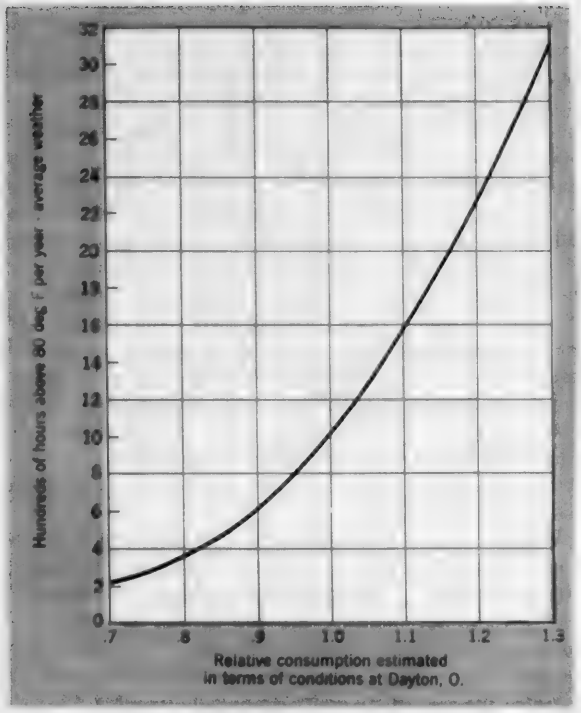


Fig. 7. Estimated relative daily hot water consumption for different U. S. areas as related to Dayton, Ohio.

It would be best, in order to get final temperatures all year round, to use the coldest water temperature normally expected in the area under consideration. Automatic temperature controls take care of the warmer water conditions. Where the water gets quite cold in the winter time, a tempering or warming tank placed ahead of the hot water heater, can be utilized to reduce the load on the heater. Figure 5 illustrates the use of a tempering tank in conjunction with a gas storage heater. In large volume installations, where the size of the boiler is unduly increased in size and cost because of very cold water received in winter, a heated tempering tank, as an automatic water heater set for a low temperature, might save considerable investment. Multiple low cost water heating units in series may show a saving in winter operation. These could be switched to parallel operation during the hot summer months where the hot water load is probably increased in the same proportion of heat requirement, as the colder water with lower winter gallon requirements.

In order to obtain the quantity of hot water that would be obtained under conditions other than the base or design temperature rise, this formula can be applied:

$$\text{Equivalent gallons for the new temperature rise} = \text{Gallons heated for base temp. rise} \times \frac{\text{New temp. rise}}{\text{Base temp. rise}}$$

For 100 gallons per hour based on 60 F rise, then for 120 F rise we would derive

Equivalent gallons at 120 F $= 100 \times 60/120 = 50$ gph

Figure 6 illustrates the effect of variations in temperature rise on the quantity of hot water obtained per 100 cu ft of natural gas fuel. Figure 7 points out the relative

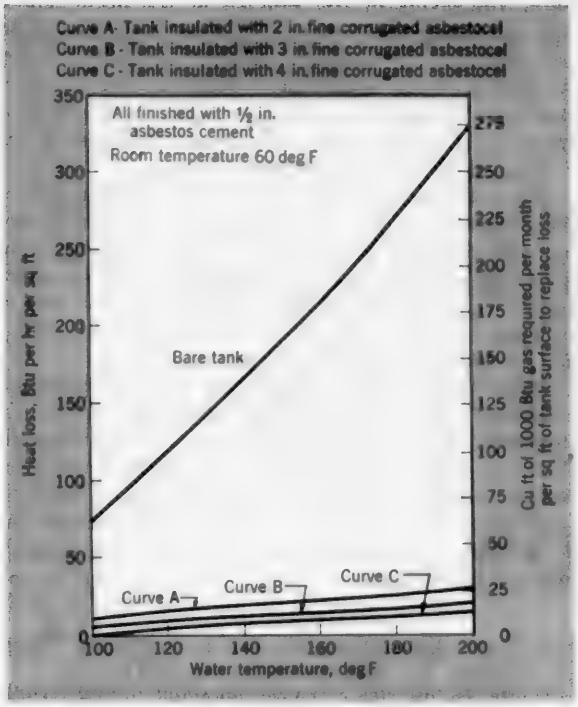


Fig. 8. Radiation losses from bare and covered hot water surfaces. AGA chart based on data from Pittsburgh Water Heater Corp.

increase in hot water gallons consumed in summer over winter conditions, in terms of the number of hours that the average weather is above 80 deg. This suggests the offsetting of the colder water of winter with the increased load of summer.

TABLE 25. POWER CONSUMPTION OF ELECTRIC PUMP*

Pump Capacity, Gpm	Diameter of Delivery Pipe, Inches	HP Required for Each Foot of Head Pressure or Lift
100	2	0.063
240	3	0.136
430	4	0.217

*Pittsburgh Water Heater Manual, Pittsburgh Water Heater Corp., Pittsburgh, Pa.

Circulating Lines vs. Water Waste

In large multi-story or long factory buildings, considerable water is wasted if a person draws hot water at the end of the line remote from the water heater, if the line has been permitted to cool off because of non-use of hot water. It also often takes considerable time for water of the proper temperature to arrive at this distant point. Table 21 shows how many feet of various sizes of piping will hold about 2.4 gal of water and Table 22 the heat loss from bare pipe surfaces.

It appears that this quantity of 2.4 gal of water contained in hot water piping is about the maximum quantity of water that can economically be wasted in the piping. Above 2.4 gal, in terms of pipe length for the size of pipe under consideration, circulation becomes essential to good hot water operations. There is considerable difference of opinion as to the economics of circulating lines, where

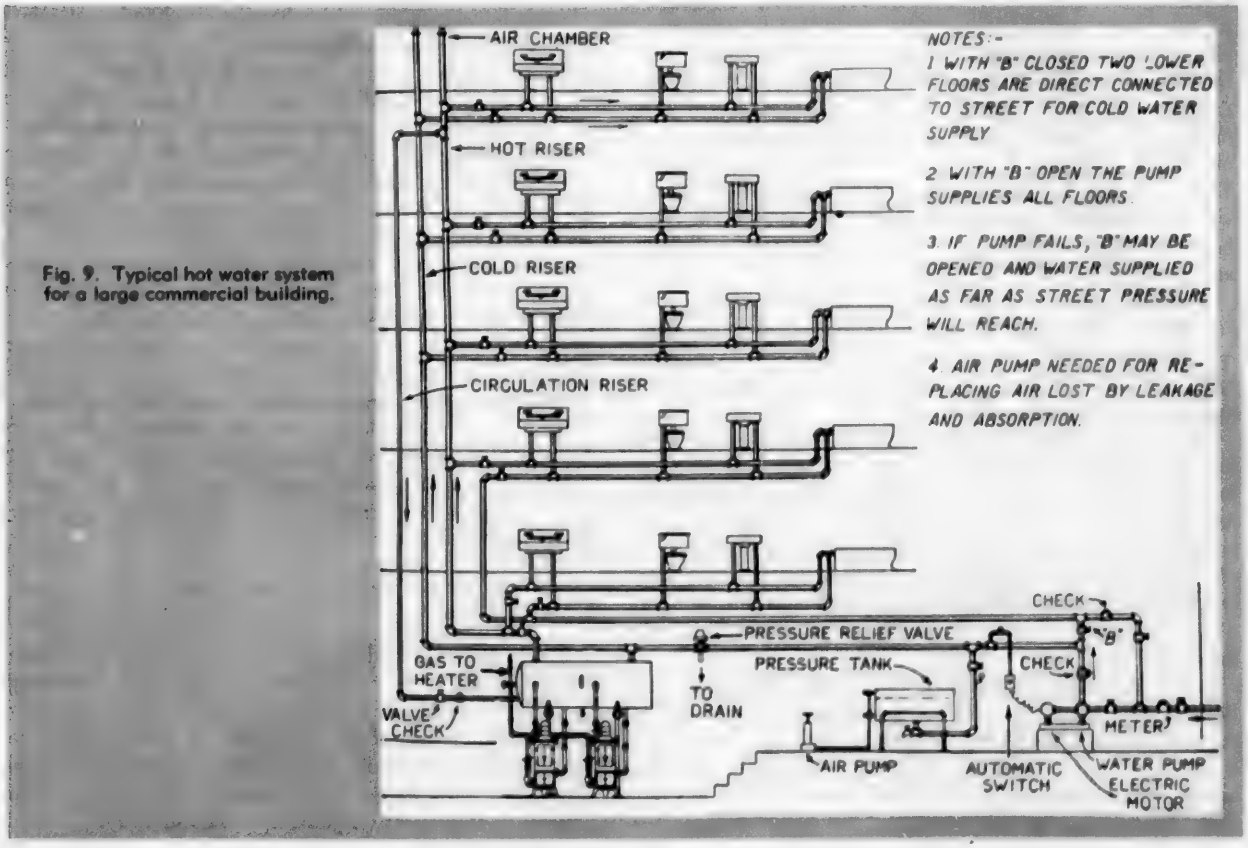

AIR CHAMBER
HOT RISER
COLD RISER
CIRCULATION RISER
NOTES:-
1. WITH "B" CLOSED TWO LOWER FLOORS ARE DIRECT CONNECTED TO STREET FOR COLD WATER SUPPLY
2. WITH "B" OPEN THE PUMP SUPPLIES ALL FLOORS.
3. IF PUMP FAILS, "B" MAY BE OPENED AND WATER SUPPLIED AS FAR AS STREET PRESSURE WILL REACH.
4. AIR PUMP NEEDED FOR REPLACING AIR LOST BY LEAKAGE AND ABSORPTION.
CHECK
"B"
PRESSURE RELIEF VALVE
PRESSURE TANK
CHECK
GAS TO HEATER
TO DRAIN
VALVE
CHECK
METER
AIR PUMP
AUTOMATIC SWITCH
WATER PUMP ELECTRIC MOTOR

Fig. 9. Typical hot water system for a large commercial building.

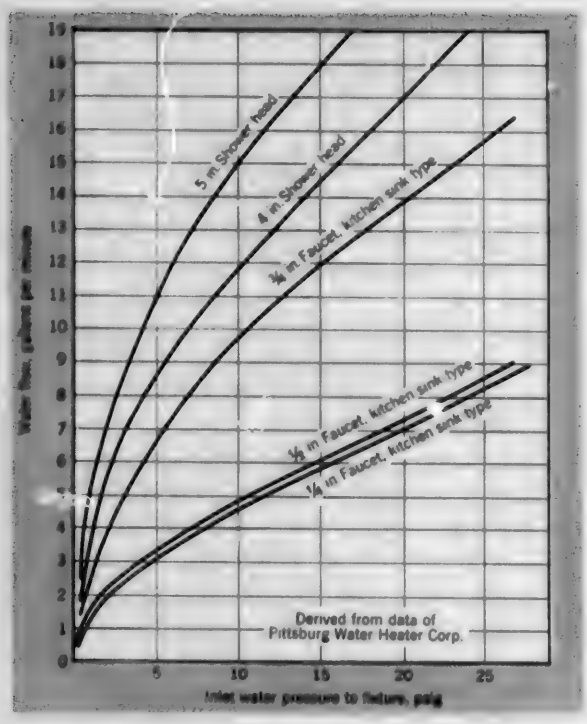

5 in Shower head
4 in Shower head
⅜ in Faucet, kitchen sink type
½ in Faucet, kitchen sink type
¼ in Faucet, kitchen sink type
Derived from data of
Pittsburg Water Heater Corp.
Water flow, gallons per minute
Inlet water pressure to fixture, psig

Fig. 10. Discharge capacity of typical fixtures for different inlet pressures. Discharge pressure is constant at atmosphere.

there is a fairly constant use of hot water, as would occur in hotels, all-day restaurants and hospitals. In taller multi-story buildings, it may be unnecessary to install circulating lines below the fourth floor because the usage of hot water by the upper floors would serve to keep the water in the lower mains warm. Smaller buildings may not require circulating lines, although many well designed homes have installed such lines. Circulating lines are of greatest importance where the use of hot water is intermittent, as in office and loft buildings, department or other stores, warehouses, shops, factories and garages. The pipe lines contain considerable quantities of hot water which would be wasted if allowed to cool. Having hot water ready at the faucet saves time, tempers, water and fuel.

It is common practice to devise a complete circuit consisting of a hot water riser and down leg returning the hot water to the storage tank. Connections for supply can be made from either the riser or the down leg, for the appliances at different locations.

Where hot water is not circulated, the smaller the hot water delivery line, the shorter will the wait be for hot water, the less the water volume loss, and the correspondingly smaller amount of heat lost from the smaller weight of water left to cool and the reduced surface area of the pipe. This is illustrated by Table 23 which gives the length of different sizes of pipe that will hold one gallon of water and the amount of radiating surface per foot of pipe.

Hot water supply lines should be as small as practicable. Reducing 50 ft of 1 in. line to ¾ in. has the same effect as moving the heater 19 ft nearer to the fixtures. Changing a ⅜ in. line to ½ in. brings it 21.5 ft closer to the heater. The saving in fuel cost will show up in a short time. The saving in the investment becomes evident at once. The saving of 100 Btu per hr per lineal foot of pipe would represent a saving of 12,000 cu ft of 1000 Btu per cu ft gas per month of 720 hours, for every 100 ft of such pipe. The curves of Fig. 8 illustrates the savings in Btu heat loss and in cubic foot of gas that would result from covering the piping with various thickness of fine corrugated asbestocel insulation.

Figure 8 points out that with constant circulation, pipe lines remain hot and lose heat 24 hours a day. It then becomes advisable to insulate and cover all circulating, supply and return lines. Larger hot water mains installed vertically with not too many bends or frictional flow resistance, sustain a natural circulation within the piping, and circulating lines are not essential.

Where an overhead storage tank is used, there is a possibility of losing considerable hot water if the discharge end of the vent or expansion pipe is not sufficiently above the level of the water in the tank. The distance between the discharge and the water level should be 3½% of the distance from the water level in the roof tank and the low point in the water system. For example, Table 24 suggests vent lengths.

Typical Circulating System

Figure 9 illustrates a typical hot water piping lay-out, using a circulating system, water pump, basement pressure pump, and other important items, like check valves, pressure relief valves and connections to expansion air chambers, all tied to typical fixtures on five floors. The service line from the right has its main shut-off valve, water meter, check valve and line, feeding the first two floors directly with cold water. All other floors and the hot water system are served with cold water from the electric booster pump, which has the air chamber attached for smooth non-pulsating flow.

The hot water supply consists of a riser from the hot water storage tank. All fixtures on all floors are fed from the riser main. The vertical circulating line takes off from the riser at the top floor and returns to the bottom of the hot water storage tank. One can observe the flexibility in the arrangement of valves and controls. The two lower floors can be fed cold water either directly from the street supply or by means of the pump, if the main pressure gets too low. An air pump is designed into the system to supply the air chamber with its air cushion. The storage tank water is heated by means of two multi-coil water heaters joined to the tank in parallel.

The effect of reduced pressures in tall buildings on the flow of water through some simple fixtures, is shown in Fig. 10. The need for booster pumps with proper air chambers and controls, occurs frequently. The power consumption of the electric pump will average the horsepower in Table 25.

Credit for Tables

The data contained in much of the tables have been derived, unless otherwise noted, directly or indirectly from practical groundwork undertaken by and completely under the guidance of the American Gas Association. The original data were published in the association's Industrial Gas Series. Some of the tables are abstracted from articles in Industrial Gas during 1954 and 1955.

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Supports for Hot Water Storage Generators

A HOT WATER storage generator is the heart of a service hot water system. When this unit is properly installed with its component arrangement of piping, it can be depended upon for efficient hot water generation. A service hot water system represents an extensive phase of design. While there are any number of details about this system that can be discussed only the hot water storage generator and some of the pertinent facts regarding its installation and support will be considered.

Location

During the initial design of the service hot water system, the location of the storage generator becomes one

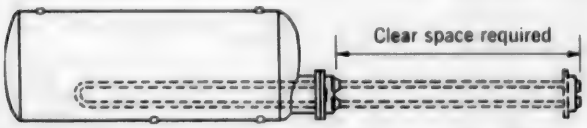


Fig. 1. Clear space required for removing heating coils in a hot water storage generator.

of the first factors bearing consideration. The unit may be located in the boiler room, utility room, or any other designated space.

We shall assume that the generator will be located in the boiler room. Here it is close to the steam plant, the source of heat required for hot water generation. Now that the unit has been located in the boiler room, it is important to provide adequate space for its proper installation. This is best accomplished by a meeting with the heating engineer to insure sufficient space for the unit as well as an adequately sized boiler room. The hot water storage generator in order to function at its best, must have ample room for generator inspection, maintenance and care. All of these are important for good operation.

Clearance for Maintenance and Repair

Allotment of space for the hot water storage generator should also include enough room for piping arrangement and hook-up. Some clearance should be allowed for the inspection, maintenance and repair of the heating coils contained within the storage generator.

Figure 1 shows the space required for removing these heating coils. The copper coils occupy approximately two-thirds of the length of the storage generator. The overall length of the coils determines the amount of space or clearance required for their removal. Periodic removal of the coils is necessary during coil inspection. Removal is also required for the repair or replacement of the coils. It is imperative that the proper amount of room be allowed to facilitate this very important function.

Size of Generator

The actual size and capacity of this unit is dependant upon the contemplated hot water demand in the building. Should the demand be of such proportions that the unit will exceed practical physical dimensions, it is then advisable to consider the installation of two storage generators rather than one. Figure 2 represents such an installation.

Referring to Fig. 2, one will note that the two units require more space in width but less space in length. Yet the two units are equivalent in capacity to the larger unit. When two units are used they frequently offer certain advantages not obtainable with a large single unit. One of the advantages permits the operation of only one of the units during the off-peak hours of the day or season.

Another advantage is that two units allow one to be inspected or repaired while the other continues to supply the hot water requirements of the building. Such an advantage avoids the total shutdown of the service hot water system and provides a flexible arrangement in the manner of hot water generation.

It is recommended that when the hot water demand of a project requires a hot water storage generator of such size in length and capacity to be enormous, the engineer should seriously consider the installation of two

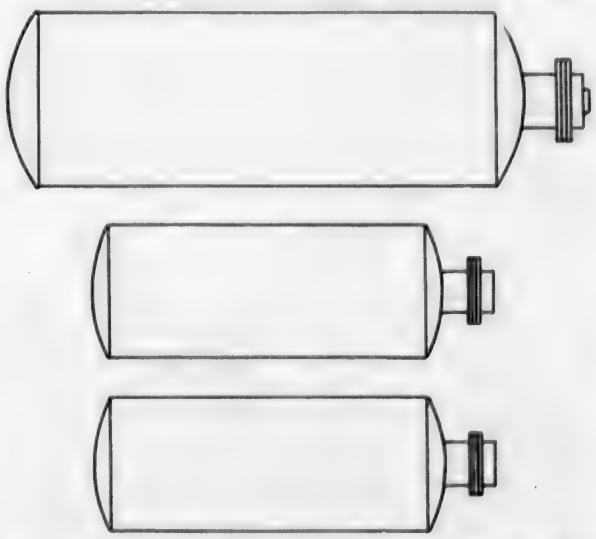


Fig. 2. Two hot water storage generators may be used when space is not ample for one of combined capacity.

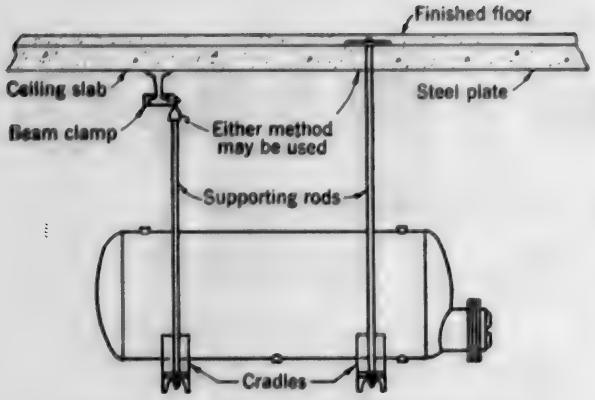


Fig. 3. Two methods for supporting hot water storage generator from ceiling.

units. It is certainly both more practical and economical in this instance to utilize that versatile arrangement that two units offer.

Units Supported From Ceiling

Hot water storage generators may be installed in a number of different ways depending upon the particular needs or space requirements of the project. It is often necessary to support the unit from the ceiling when the floor space is crowded with other equipment. This method is recommended only for units that are not too heavy. It might be stated that the unit should always be mounted on the floor and that supporting the unit from the ceiling is permissible only when the space limitations prevent the proper installation.

Two methods that can be used in supporting the unit from the ceiling are shown in Fig. 3. One method shows the hot water storage generator supported by means of steel rods and a beam clamp. The beam clamp is attached to the steel beams in the ceiling construction. The other method indicates how the unit can be supported by means of steel rods and a steel plate placed in the upper floor construction. In either method the unit rests on a steel cradle which is in turn supported by a suitable steel beam or channel. Steel rods permit the cradles to be hung from a beam or channel.

Other variations of support can be used to support the unit. The methods shown are for example and convey the general nature of the support and its installation. When this means of support is used, the steel rods and other construction materials shall be of adequate strength to carry the weight of the unit.

Units Supported on a Pipe Stand

When floor space is available and the unit is not too heavy, a sturdy pipe stand can be used to support the hot water storage generator, as illustrated by Fig. 4. Here the tank rests on a suitable cradle which in turn is bolted to the pipe stand. The uprights are cross-connected by steel rods or small diameter pipe to ensure a durable piping frame that cannot sag. The uprights are secured to steel floor plates or are bolted to the floor construction by means of concrete inserts or anchor bolts. This type of support is easily assembled and when properly erected, this support can be counted upon for long reliable service.

Units Supported on Brick or Masonry Piers

The more conventional way of supporting hot water storage generators, regardless of weight or size is by means of brick or concrete piers. This method, Fig. 5, is highly recommended.

The brick or masonry supports are erected on the concrete slab. The hot water storage generator rests on cradles which in turn are carried by the piers. This type of support is the kind more generally used for construction purposes because it is durable and will provide for years of service in a safe manner. Often, however, the provision of suitable piers is not enough. Consideration must also be given to the strength of the floor slab on which the piers rest.

Adequate Footing

A hot water storage generator is a rather heavy unit even when empty. The same unit after connection of necessary piping and filled with water is considerably heavier. Not only should consideration be given to the strength of the piers but also to the adequacy of the concrete floor slab on which the piers are constructed.

It is the engineer's responsibility to inform the structural engineer of the total weight of the unit, when filled, including the weight of the connected piping. This information will enable the structural engineer to provide a slab of sufficient proportions to carry the combined weight of the unit as well as the piers.

In many cases a heavier slab will not suffice for the concentrated load placed upon it. When this condition is experienced, thought should be given to other methods that can be employed.

Very often, separate footings are poured to carry the piers. The weight of the unit and the piers are then supported by the footing rather than by the slab.

When fill or unstable soil conditions exist at the site, more extensive study must be given to the proper support. In this instance, piles of wood or concrete are driven down to stable earth to withstand the loading of the total weight of the unit and its component parts. A concrete footing is then poured integral with the top of the piles to provide a more suitable bearing surface for the piers.

Other methods can be utilized to provide adequate footing for the piers. In any event, it is imperative that careful consideration be given this unit to prevent even the slightest chance of settlement. Precautions taken early

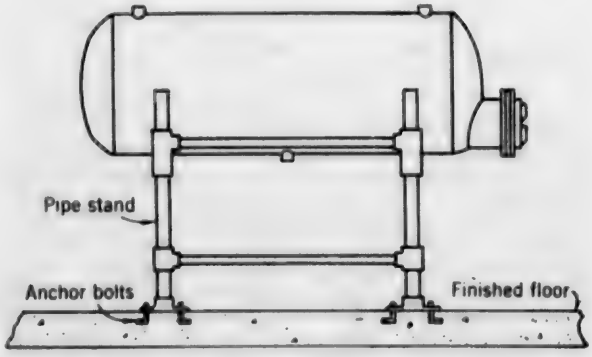


Fig. 4. Rigid pipe frame to support a hot water storage generator.

will avoid the costly corrective measures to provide adequate footing after the unit has settled. In addition, damage to the concrete floor slab or the piping system will likewise be prevented.

Replacement of Units

Whenever a hot water storage generator is installed in a building, thought must be given to that eventual day when the unit will have to be replaced.

If the unit is a small one, there should be sufficient space and clearance to slide the old unit out of the building and to slide a new unit in its place. When the boiler room is at ground floor level, the problem is somewhat simplified since it is necessary only to provide doors of sufficient size to allow for the passage of the unit.

If the boiler room is located at a lower level in the building, the problem is made more difficult since it is then necessary to provide suitable means for lifting the old unit out and the new unit in.

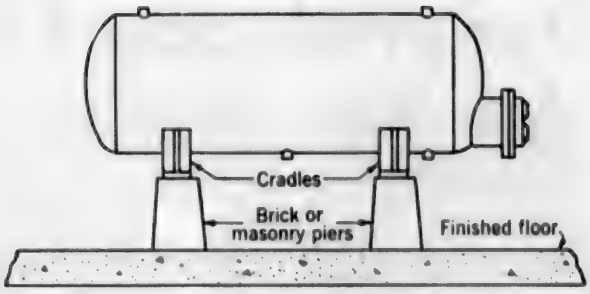


Fig. 5. Hot water generator supported on brick or masonry piers.

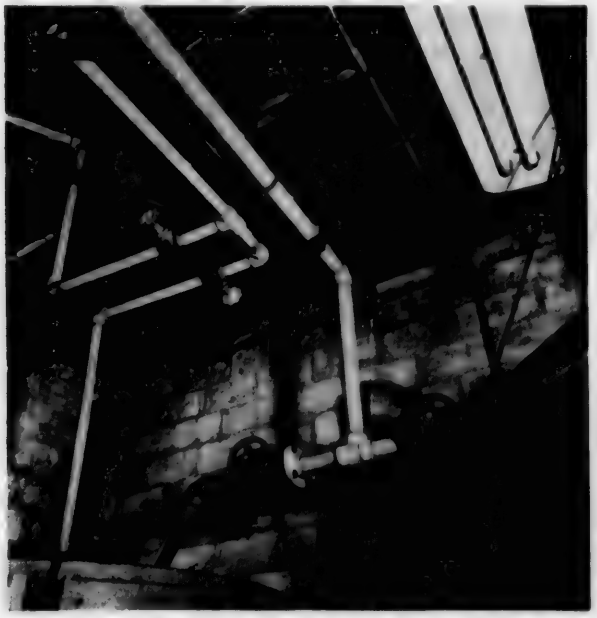
The same considerations apply to the larger storage tanks, with the exception that such units are taken apart and the new unit is welded together in place. Here too, sufficient room for passage is required in accordance with the size of the sections to be welded together.

Corrosive Liquids Transported by Plastic Pipe

A complete changeover from metal to polyvinyl chloride plastic pipe in all of its threaded process piping has been made by J. H. Erbrich Products Co., Indianapolis, Ind. The company is a major producer of vinegar, mustard, bleaches, liquid fertilizer and a number of other commodities.

The plastic piping has come to have an important role in the company's strict quality control program, since it eliminates corrodents that might affect the purity and color of Erbrich products. The cost of the piping was also much less than screwed piping of other materials suitable for this service, and has sharply cut maintenance overhead.

Where plastic pipe is used, Erbrich's processing operations are carried on at atmospheric temperatures. Pressures range from 50 to 100 psi. The piping was fabricated with PVC injection molded fittings produced by Tube Turns Plastics, Inc., Louisville, Ky.



One application of plastic pipe in plant of J. H. Erbrich Products Co.

In one of the plant applications, ¾, 1 and 1½ in. plastic piping is employed in transferring apple cider and distilled vinegar from wooden make-up and storage vessels to the bottling lines. The vinegar contains 12% acetic acid in its uncut stage, and 4% acetic acid when prepared for table use. Formerly, this piping was fabricated of Type 316 stainless steel, Schedule 40, and directional changes were made with conventional screwed fittings. Its service life was only 12 to 24 months. Plastic pipe, installed late in 1953, shows no evidence of deterioration and is expected to last for many years.

In a second application, 1 and 2 in. plastic piping is used in the preparation of a household bleach that has a sodium hypochlorite content of 5.25%. It transfers a solution of caustic soda and water from the make-up tank to the mix tank where chlorine gas is added. Then it conveys the finished bleach to the bottling lines. Both tanks have a capacity of 600 gallons and are constructed of carbon steel lined with rubber. Previously wrought iron screwed piping was employed for the caustic soda and water solution, and rubber hose for the dilute sodium hypochlorite. Both were subject to early failure due to the highly corrosive solutions conveyed and the corrosive action of chlorine fumes. Plastic pipe installed more than a year ago has not the slightest indication that the bleach has affected it.

In this plant, 1½ in. plastic pipe carries a fertilizer solution from wooden mixing and storage vessels to tank trucks, carboy filling stations and bottling lines. It contains 6% nitrogen, 18% phosphoric acid, 6% soluble potash, and traces of zinc, copper, boron, sulfur, iron, manganese and magnesium. Although the fertilizer is very corrosive the plastic pipe has remained fully serviceable over a long period.

The PVC fittings used by Erbrich for directional changes in its piping are made by the exclusive Hendry injection molding process employed by Tube Turns Plastics, Inc.

Underwindow Fan-Coil-Filter Units for Year-Round Air Conditioning

GAYLE B. PRIESTER

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This article presents in an unbiased manner, specification data on existing standard air cooling equipment designed for the use of chilled water in residential, apartment, and office air conditioning applications. In general, these units may also be used for heating in the winter by circulating hot water through them. The various equipment items described are known as free standing fan-coil-filter units.

AT present, the cooling of residences is the fastest growing application of air conditioning and the potential market is stupendous. Also there still are more offices being air conditioned than any other one application. Therefore, equipment suitable for house, apartment, or office cooling has a great many possible applications. The number of unconditioned existing houses, apartments, and offices far exceeds the new ones built each year; free standing fan-coil filter units are applicable for both new and existing buildings.

Advantages of these remote type year-round room air conditioning units include the following:

1. Individual room control of temperature and air quantity is available.
2. There is no direct recirculation of air from one room to another.
3. Outside air can be supplied directly to each room.
4. No supply air ductwork, which takes up space and may be difficult to install, is required.
5. Units may be located under windows where the floor space usually is not so valuable.
6. Existing radiators may be replaced.
7. No refrigerant piping is needed.
8. Only simple electrical and plumbing connections are required.
9. Heating and cooling are provided at the windows at the exterior wall of the structure where the load is the greatest.

Most makes of units have 2- or 3-speed fan operation which is usually manually controlled to suit the room occupant. The temperature in the room is controlled by regulating the flow of water through the coil in the unit. The water valve used may be designed for manual operation or for thermostatic operation. A room thermostat may control the valve in one unit or the valves on several units simultaneously depending upon the number of units in a room or on the type of zone control desired. The room occupant may obtain some manual control of relative humidity by operating the fan at one of the lower speeds on mild humid days.

Possible Applications

Satisfactory installations have been made in the following applications:

1. Houses
2. Apartments
3. Motels
4. Hotels
5. Offices
6. Hospitals
7. Schools
8. Country Clubs

The air conditioning customer or user is interested only in three major items with reference to the installation in his house or building, namely (1) results, (2) cost, and (3) appearance, though not necessarily in that order. No comparative data on cost nor appearance are given here, but it is hoped that the information that is presented will aid the design engineer so that he can provide the cus-

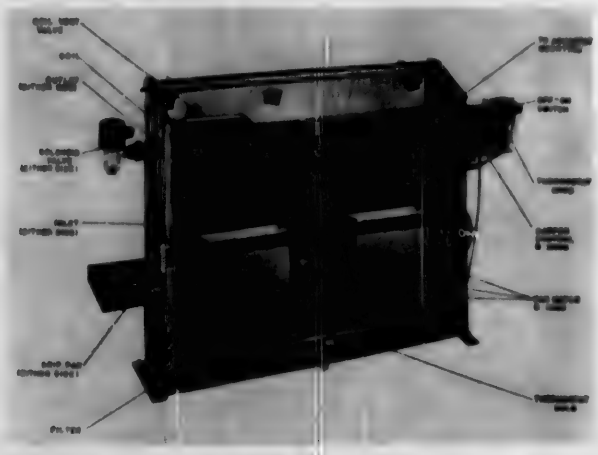


Fig. 1. Room unit made by Chrysler Corp., Airtemp Div., Dayton, Ohio.

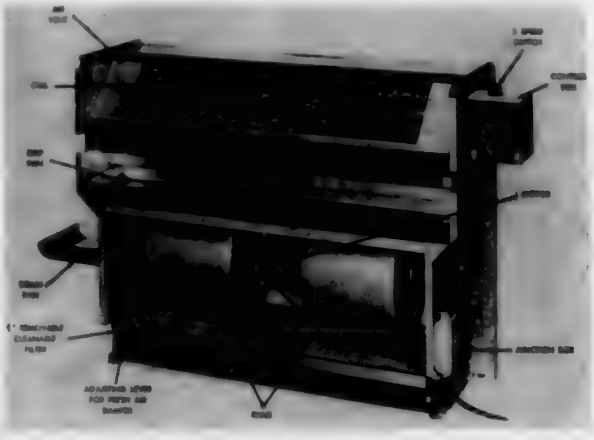


Fig. 2. Spotaire unit made by Drayer-Hanson, Inc., Los Angeles, Calif.

A FEW OF THE UNITS SERVED BY HOT OR CHILLED WATER THAT ARE AVAILABLE FOR YEAR-ROUND AIR CONDITIONING

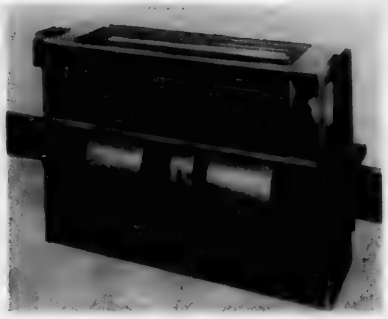


Fig. 3. Yorkaire conditioner, York Corp., York, Pa. This is the basic type unit, Model CF.

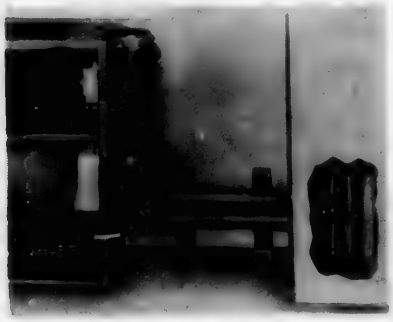


Fig. 4. Installation of piping for Yorkaire conditioner, Model CF, illustrated above. It shows riser connections.

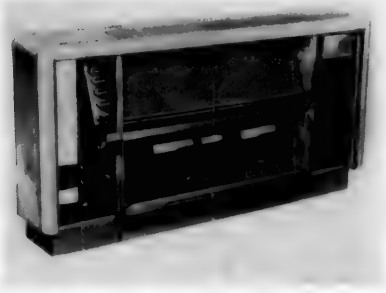


Fig. 5. Unitrane room unit, type DD. The Trane Co., La Crosse, Wis.

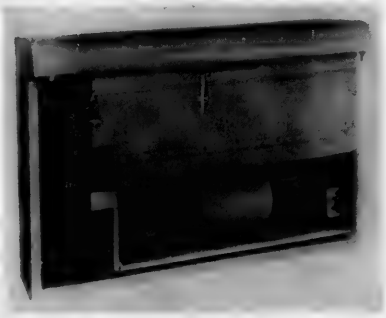


Fig. 6. Room unit, Model BAC. Brown Products Co., Forest Hills, N. Y.

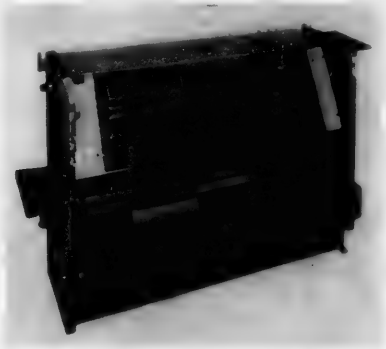


Fig. 7. Seasonmaker room unit. McQuay, Inc., Minneapolis, Minn.

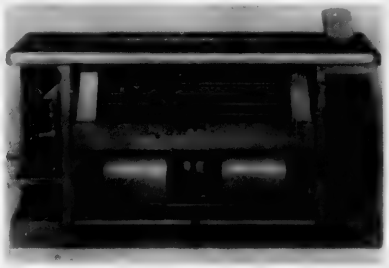


Fig. 8. Room unit, Model FWC. Marlo Coil Co., St. Louis, Mo.

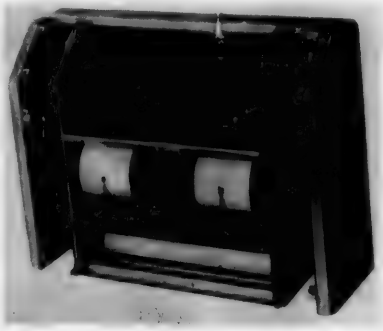


Fig. 9. Vari-Temp room unit. C. A. Dunham Co., Chicago, Ill.

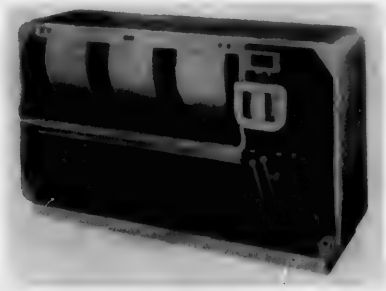


Fig. 10. Amervent, Model CC. American Air Filter Co., Louisville, Ky.

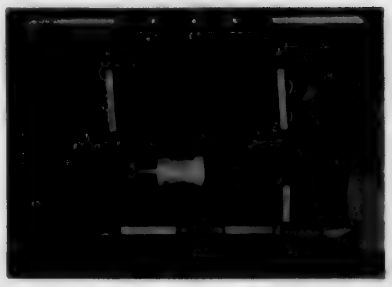


Fig. 11. Airditioner, Model CC. Modine Manufacturing Co., Racine, Wis.

Fig. 12. Hydraline air conditioner. Borg-Warner Corp., Kalamazoo, Mich.

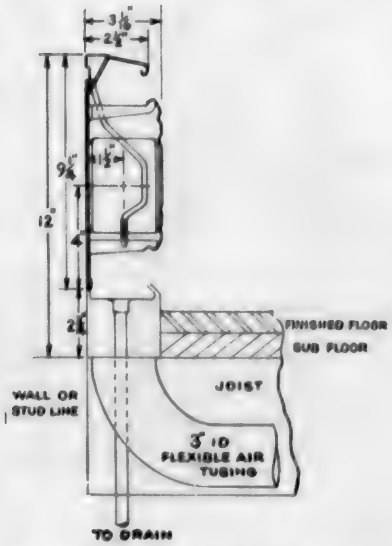


Fig. 13. Air supply and condensate drain for baseboard unit. Vulcan Radiator Co., Hartford, Conn.

TABLE 1. SPECIFICATION DATA FOR UNDERWINDOW UNITS DESIGNED FOR

Make	Model No.	Free Standing Units: Width, Inches	Height, Inches	Depth, Inches	Supply Grille	Cooling Capacity[a]	Sensible Heat Ratio[a]	Heating Capacity[b]	Cfm: High	Cfm: Low	Coil Tubes: O.D., Inches	Material	No. of Rows
Acme Industries	CV7	26¾	24	11⅜	Top or	7,700[c]	0.67	15,700[c]	—	—	⅜	Copper	—
	CV12	34¾	24	11⅜	front;	12,400[c]	0.67	26,000[c]	—	—	⅜	Copper	—
	CV18	58¾	24	11⅜	fixed va.	19,600[c]	0.67	39,000[c]	—	—	⅜	Copper	—
American Air Filter	2110	39	30	14¾	On top;	14,750[m]	0.65	22,000[l]	500	400	⅜	Brass	4
	3110	50	30	14¾	fixed	22,140[e]	0.65	33,000	750	600	⅜	Brass	4
	4110	61	30	14¾	vanes	29,500[n]	0.65	44,000	1000	800	⅜	Brass	4
	5110	72	30	14¾		36,840[o]	0.65	55,000	1250	1000	⅜	Brass	4
American Blower	200	38	25	9¼	On top;	6,725	0.63	16,000	200	150	½	Copper	4
	300	47	25	9¼	fixed	10,750	0.63	24,000	300	225	½	Copper	4
	400	56	25	9¼	vanes	14,700	0.60	32,400	400	300	½	Copper	4
	500	65	25	9¼		18,587	0.60	40,580	500	375	½	Copper	4
	600	74	25	9¼		22,750	0.60	49,200	600	450	½	Copper	4
American Standard	200	37⅞	25	13⅛	On top;	6,700	0.70	15,300	210	—	⅝	Copper	4
	300	37⅞	25	13⅛	adjust.	9,400	0.68	20,000	300	—	⅝	Copper	4
	400	49⅞	25	13⅛	vanes	14,700	0.60	32,100	400	—	⅝	Copper	4
	600	65⅞	25	13⅛		20,500	0.67	46,100	610	—	⅝	Copper	4
Borg-Warner	135	23½	18	6	Front;	2,300	—	6,800	90[p]	—	—	Copper	—
	250	32	22	6	3-way fix.	4,700	—	12,500	165[p]	—	—	Copper	—
Brown Products	27	36	24	10⅜	On top;	5,560	0.64[l]	10,800	210	—	⅝	Copper	4
	45	50	24	10⅜	punched	11,180	0.64[l]	22,700	390	—	⅝	Copper	4
	60	—	—	——	holes	——	—	——	—	—	⅝	Copper	4
Bush	66	47½	25	9½	On top;	6,950	0.69	13,200	220	200	⅝	Copper	2
	100	48½	25	9½	fixed	10,466	0.69	19,500	330	300	⅝	Copper	2
	135	57½	25	10¼	vanes	14,660	0.69	32,600	450	400	⅝	Copper	2
	180	71½	25	10¼		18,640	0.69	41,300	600	540	⅝	Copper	2
Carrier	36Q2	30	26	11½	On top;	6,090[g]	0.78	15,800[g]	200	150	—	Copper	3
	36Q4	42	26	11½	fixed	13,850[l]	0.67	34,700[l]	400	300	—	Copper	3
	36Q6	58	26	11½	vanes	21,300[m]	0.66	50,500[m]	600	450	—	Copper	3
Chrysler	1820	48¼	26	8¾	Top front	9,700[k]	—	14,600[c]	200	—	⅜	Tin	3
	1830	48¼	26	8¾	corner;	12,400[k]	—	18,600[c]	300	—	⅜	plated	3
	1840	48¼	26	8¾	adj. vanes	14,000[k]	—	21,000[c]	400	—	⅜		3
Drayer-Hanson	200	34½	25	11	On top;	6,900	0.68	17,100	200	—	⅝	Copper	4
	400	44	25	11	adjust.	13,100[m]	0.69	32,600[m]	400	—	⅝	Copper	4
	600	57	25	11	vanes	18,900[m]	0.70	48,300[m]	600	—	⅝	Copper	4
Dunham	100	36	25	10¾	Top front	9,566[g][l]	0.54	14,100[g]	244	187	—	Copper	3
	250	47	25	10¾	corner;	17,590[g][l]	0.39	40,000[g]	692	538	—	Copper	3
	350	51	32	13¾	fixed va.	33,950[g][l]	0.35	56,200[g]	970	756	—	Copper	3
Frick	66	47½	25	9⅜	On top;	6,600[j]	0.63	14,000[k]	180	150	—	——	—
	100	48½	25	9⅜	fixed	10,000[j]	0.63	21,000[k]	275	220	—	——	—
	135	57½	25	10⅛	or adj.	13,500[j]	0.63	29,000[k]	370	300	—	——	—
	180	71½	25	10⅛	vanes	18,000[j]	0.63	38,000[k]	500	400	—	——	—
Marlo	203	—	—	8½-10	On top;	6,750[g]	0.67	16,000[h]	210	—	½	Copper	3
	403	—	—	8½-10	fixed or	13,500[g]	0.67	32,000[h]	420	—	½	Copper	3
	603	—	—	8½-12	adj. vanes	20,250[g]	0.67	48,000[h]	630	—	½	Copper	3
	204	—	—	10	On top;	8,200	0.65	18,500[l]	210	—	½	Copper	4
	404	—	—	10	fixed or	16,400	0.65	37,000[l]	420	—	½	Copper	4
	604	—	—	10-12	adj. vanes	24,600	0.65	55,500[l]	630	—	½	Copper	4
McQuay	2	34	25	10⅛	On top;	6,850	0.70	10,800[f]	200	—	⅝	Copper	4
	4	50	25	10⅛	fixed or	13,450[d]	0.70	21,500[f][d]	400	—	⅝	Copper	4
	6	50	25	12⅛	adj. vanes	21,800[o]	0.71	33,500[f][o]	600	—	⅝	Copper	4
Modine	67	34	25	11½	On top;	7,400	0.70	17,500	220	165	⅝	Copper	3
	150	48	25	11½	fixed or	16,500	0.66	37,500	440	330	⅝	Copper	3
	200	64	25	11½	adj. vanes	22,300	0.67	51,700	640	495	⅝	Copper	3
Refrigeration Appliances	50	27¼	25⅛	12¾	Top front	6,750[c]	—	——	175	—	¾	——	—
	75	32¼	25⅛	12¾	corner;	9,200[c]	—	——	246	—	¾	——	—
	10	36¼	25⅛	12¾	fixed	12,500[c]	—	——	350	—	¾	——	—
	15	43¼	25⅛	12¾	vanes	18,600[c]	—	——	535	—	¾	——	—
	20	48¼	25⅛	12¾		23,800[c]	—	——	580	—	¾	——	—
Trane	22	36	25	9¼	On top;	6,300	0.73	14,630	200	130	⅝	Copper	2
	32	42	25	9¼	fixed	9,900	0.70	21,120	300	200	⅝	Copper	2
	42	48	25	9¼	or adj.	13,900	0.68	29,920	400	260	⅝	Copper	2
	62	60	25	9¼	vanes	21,500	0.67	45,650	600	400	⅝	Copper	2
Warren Webster	C40	14	20	6¼	Front; fix. va.	3,000[a]	0.71	7,100[a]	150	90	—	Copper	—

Table continued on pages 102 and 103; see page 102 for footnotes.

HOT OR CHILLED WATER TO PROVIDE YEAR-ROUND AIR CONDITIONING

No. of Face Tubes	Coil: Face Area, Sq Ft	Coil: Fin Spacing, per In.	Coil: Fin Material	Fans: No.	Fans: Max. rpm	Fans: No. of Speeds	Fan Motor: Hp	Fan Motor: Type	Cabinet: Material, Finish and Insulation	Filter
—	—	7	Alum.	—	1080	3	—	—	20 ga. steel;	½ in. throw
—	—	to	Alum.	—	1080	3	—		buff prime coat;	away
—	—	11	Alum.	—	1080	3	—		½ in. glass insulation	
12	—	—	Alum.	3	1100	2	⅛	—	18 ga. steel;	1 in. throw
12	—	—	Alum.	4	1100	2	⅛		prime coat;	away or
12	—	—	Alum.	5	1100	2	1/6		enamel optional	cleanable
12	—	—	Alum.	6	1100	2	¼			
—	—	—	Alum.	1	—	2	25M	Shaded	18 and 20 ga. steel;	1 in. throw
—	—	—	Alum.	1	—	2	35M	pole	baked tan enamel or	away or
—	—	—	Alum.	1	—	2	1/20		prime coat;	cleanable
—	—	—	Alum.	1	—	2	1/15		1 in. glass insulation	
—	—	—	Alum.	1	—	2	1/12			
4	—	—	—	2	—	3	35M	—	18 and 20 ga. bonderized	1 in. throw
4	—	—	—	2	—	3	1/15		steel; baked on	away or
4	—	—	—	2	—	3	1/15		tan enamel;	cleanable
4	—	—	—	2	—	3	⅛		insulation	
9	—	—	—	1	920	10	—	—	—	Throw
9	—	—	—	2	—	10	—	—	—	away
4	—	—	Alum.	1	—	3	1/25	Shaded	20 ga. steel; prime	Cleanable
4	—	—	Alum.	2	—	3	2-1/25	pole (4)	or baked enamel;	
4	—	—	Alum.	2	—	3	—		glass insulation	
5	1.35	—	Alum.	2	1050	2	1/25	Shaded	18 and 20 ga. steel;	1 in.
5	1.97	—	Alum.	2	1050	2	1/20	pole	beige baked enamel;	cleanable
5	2.63	—	Alum.	2	1050	2	1/15		½ in. glass insulation	
5	3.64	—	Alum.	4	1050	2	2-1/20			
4	0.77	—	Alum.	1	1050	3	—	Shaded	18 ga. steel;	1 in. throw
4	1.34	—	Alum.	2	1050	3	—	pole	grey prime coat;	away or
4	2.11	—	Alum.	2	1050	3	—		½ in. glass insulation	cleanable
9	—	13	Alum.	2	—	2	—	—	Bonderized steel;	Throw away
9	—	13	Alum.	2	—	2	—	—	base coat;	or
9	—	13	Alum.	2	—	2	—	—	insulation	cleanable
4	—	8	Alum.	2	—	3	25M	Six	Steel;	1 in.
4	—	8	Alum.	2	—	3	35M	pole	baked grey enamel;	cleanable
4	—	8	Alum.	2	—	3	1/20		½ in. glass insulation	
5	—	—	Alum.	2	1060	2	1/20	Shaded	18 ga. steel;	Cleanable
5	—	—	Alum.	2	1060	2	⅛	pole.	brown baked	
5	—	—	Alum.	2	1060	2	¼	Capac.	enamel	
—	—	—	—	2	—	2	—	Shaded	Steel; beige baked	1 in. throw
—	—	—	—	2	—	2	—	pole	enamel; ½ in. glass	away or
—	—	—	—	2	—	2	—		insulation	cleanable
—	—	—	—	2	—	2	—			
—	—	10	Alum.	1	1550	2	—	Shaded	18 ga. bonderized steel;	1 in.
—	—	10	Alum.	2	1050	or	—	pole or	prime coat or baked grey	cleanable
—	—	10	Alum.	2	1140	3	—	split	enamel; ½ in. glass	
								capacitor	insulation	
—	—	10	Alum.	1	Ditto	2	—	Ditto	Ditto	Ditto
—	—	10	Alum.	2	Ditto	or	—			
—	—	10	Alum.	2	Ditto	3	—			
8	—	—	Alum.	2	1050	3	1/30	Shaded	Bonderized steel;	1 in. throw
8	—	—	Alum.	2	1050	3	1/30	pole	baked grey enamel;	away or
8	—	—	Alum.	2	1050	3	1/12		½ in. insulation	cleanable
5	—	—	Alum.	1	1050	3	1/30	—	18 and 20 ga. bonderized	Throw away
5	—	—	Alum.	2	1050	3	1/25	—	steel; baked on	or
5	—	—	Alum.	2	1050	3	1/12	—	primer; ¾ in. glass	cleanable
—	0.54	—	—	—	—	2	1/20	—	—	1 in.
—	0.71	—	—	—	—	2	1/20	—		cleanable
—	0.92	—	—	—	—	2	1/20	—	Sun tan wrinkle	
—	1.38	—	—	—	—	2	1/12	—	baked on or prime coat;	
—	1.71	—	—	—	—	2	1/12	—	fully insulated	
5	—	12	Alum.	1	1550	3	1/30	Shaded	18 ga. bonderized steel;	1 in glass
5	—	12	Alum.	1	1550	3	1/25	pole	prime coat;	fiber or
5	—	12	Alum.	2	1550	3	1/20		glass fiber blanket	cleanable
5	—	12	Alum.	2	1550	3	1/12			
—	—	—	Alum.	1	1000	3	—	—	—	—

Table continued on pages 102 and 103; see page 102 for footnotes.

TABLE 1. SPECIFICATION DATA FOR UNDERWINDOW UNITS DESIGNED FOR

Make	Model No.	Free Standing Units: Width, Inches	Height, Inches	Depth, Inches	Supply Grille	Cooling Capacity[a]	Sensible Heat Ratio[a]	Heating Capacity[b]	Cfm: High	Cfm: Low	Coil Tubes: O.D., Inches	Material	No. of Rows
Worthington	22	34	25	10⅛	On top;	6,850	0.70	——	200	—	⅜	Copper	4
	42	50	25	10⅛	adjust.	14,122	0.70	——	400	—	⅜	Copper	4
	62	50	27½	12⅛	vanes	23,108	0.71	——	600	—	⅜	Copper	4
York	301	39	24 15/16	10⅜	On top;	7,785	0.85	22,500	300	200	½	Copper	2
	451	51	24 15/16	10⅜	fixed or	13,494	0.79	36,000	450	300	½	Copper	2
	601	49	27⅜	12⅜	adj. vanes	19,203	0.80	53,000	600	400	½	Copper	3

a. Btu/hr at 80 deg db 67 deg wb 1 gpm of 45 deg water per 100 cfm at high fan speed
b. Btu/hr at 70 deg db 1 gpm of 180 deg water per 100 cfm at high fan speed
c. gpm not given
d. 3 gpm
e. 4 gpm
f. With 140 deg water
g. 0.80 gpm per 100 cfm
h. 0.76 gpm per 100 cfm
i. 0.88 gpm per 100 cfm
j. 0.91 gpm per 100 cfm
k. 0.77 gpm per 100 cfm
l. with 40 deg. water
m. 0.75 gpm per 100 cfm
n. With 42 deg water, gpm unknown
o. With 160 deg water, gpm unknown
p. At recommended 6th speed
q. 0.65 gpm per 100 cfm
r. 0.59 gpm per 100 cfm
s. 0.54 gpm per 100 cfm
t. 0.55 gpm per 100 cfm and 20% less air
u. 0.83 gpm per 100 cfm

tomer with the desired results. More detailed information on any particular unit may be obtained by writing directly to the manufacturer.

It is hoped that no manufacturing concern who makes units of this type was overlooked when requests were sent out for information on these units. If any company was omitted, it certainly was not intentional. Specification data for units as manufactured by companies from whom replies were received are tabulated in Table 1. Illustrations of various units are shown in Figs. 1-13.

Many of these units are available without the cabinet and designed for recessed installation in the wall, usually under a window as shown in Fig. 12. Some of the companies whose free standing units are covered in this article plus other companies make units which are especially designed to be partly or completely recessed in the wall.

1956 Building Outlook Is Optimistic

Building construction in 1956 will be 3.6% higher in 1956 than in 1955, according to an estimate made jointly early in November by the U. S. Department of Commerce and the U. S. Department of Labor.

The following table summarizes the prediction. Figures are in *millions of dollars*:

Type	1955	1956	% Change
New residential	$15,015	$14,575	— 3
Additions and alterations (res.)	1,250	1,500	20
Non housekeeping dwellings	330	400	21
Industrial	3,105	3,275	5
Offices and warehouses	1,125	1,225	9
Stores, restaurants, garages	1,920	2,250	17
Religious	740	850	15
Educational	2,950	3,225	9
Hospitals and institutions	680	625	— 8
Social and recreational	245	275	12
Other non-residential	1,085	1,200	11
Total	$28,445	$29,400	3.6

Total residential work (first three items in the table) will be off 0.7% from $16,595 million to $16,475.

Privately financed new residential buildings will be off 3% from $14,765 million to $14,300 million. Publicly financed residential buildings will be up 10% from $250 million to $275 million. A decrease in the dollar value of new homebuilding will be largely offset by greater outlays for additions and alterations to older homes and for construction of motels and other non-housekeeping residential units.

In non-residential building, private construction will be up 14% from $7630 million to $8700 million while publicly financed non-residential work will remain virtually constant at $4225 million in 1956 compared to $4220 million in 1955.

Private non-farm housing starts in 1956 are estimated at about 1,200,000 units—100,000 fewer than in 1955 and 200,000 fewer than at the 1950 peak.

Industrial building will show an exceptionally large gain. Expanding industrial production, favorable profit positions and excellent long-range market prospects explain the expected rise of production facilities to a record level.

Probable 1956 expenditures of $2¼ billion for stores and other service establishments—many in new suburban developments and along expanding highway networks—are 17% above the 1955 total and 80% above that for 1954. A record $850 million is in prospect for religious buildings in 1956.

New construction expenditures of privately owned public utilities in the coming year are expected to remain near the 1955 level of $4½ billion, with substantial increases in the construction programs of railroads and telephone and telegraph companies offset by decreased activity on the part of electrical and gas companies. An anticipated reduction in farm construction is based chiefly on recent declines in farm income.

The outlook for most types of public construction in 1956 is for a rise of about 10% over 1955 expenditures with gains in all major categories. During the postwar period State and local governments have been faced with a growing backlog of construction needs despite increasing outlays for new projects. Requirements are especially pressing for highways, schools and sewer and water facilities. It is estimated that these three types of facilities will account for fully three-fourths of the rise in public construction and expenditures in 1956, and each will reach a new record level. Power and other facilities in connection with the St. Lawrence Seaway account for a large share of the increase in State and locally owned miscellaneous public service projects between 1955 and 1956. Expenditures for military facilities next year will continue to rise. The dollar values of public housing and conservation and development work are expected to increase in 1956 for the first time in several years.

HOT OR CHILLED WATER TO PROVIDE YEAR-ROUND AIR CONDITIONING

No. of Face Tubes	Coil			Fans			Fan Motor		Cabinet	Filter
	Face Area, Sq Ft	Fin Spacing, per In.	Fin Material	No.	Max. rpm	No. of Speeds	Hp	Type	Material, Finish and Insulation	
—	0.74	10	Alum.	2	1050	3	1/30	Shaded pole	20 ga. cold welded steel bonderized; baked enamel; insul.	1 in. glass fiber or cleanable
—	1.43	10	Alum.	2	1050	3	1/30			
—	2.19	10	Alum.	2	1050	3	1/12			
6	1.21	12	Alum.	2	—	3	1/30	Split capac-itor	18 ga. bonderized steel; prime coat; ½ in. fiberglass	1 in. glass fiber—2 in. optional
6	1.92	12	Alum.	2	—	3	1/20			
6	1.75	12	Alum.	2	—	3	1/12			

It is not intended, however, to discuss recessed units in this article.

Baseboard Units Available

In addition to the type of units detailed in Table 1 and recessed units, there are baseboard type units available for combination heating and cooling applications. Of course it is necessary to supply air to baseboard units in order to get the chilled air up in the room. Also adequate means of collecting and draining the condensate which forms on the coils must be provided.

Figure 13 shows schematically how the air is supplied and the condensate drained for one make of unit. Round feeder ducts are recommended from a cost and ease of installation standpoint. One 3 in. diameter feeder is used for each 3 to 10 ft of baseboard cooling unit. The primary air delivered varies from 6 to 8 cfm per linear foot of unit and aspirates room air in about a 1.25 to 1 ratio. Thus 14 to 18 cfm are circulated per linear foot of cooling unit.

It should also be mentioned that remote fan-coil-filter units similar to the floor-mounted types described in this article are made in a type designed for ceiling-mounting. These are usually installed over corridors or in the tops of closets. Since down drafts at the windows may be encountered when this type of unit is used for heating, it should therefore be used only where heating is not critical or where the existing heating system is to be continued.

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

HANDBOOK OF ENGINEERING MATERIALS

In order to provide engineers with authentic and useful information on the usual materials required in manufacturing and construction, a staff of specialists serving Douglas F. Miner and John B. Seastone as editors, have prepared the Handbook of Engineering Materials.

The text is arranged by class of related or similar materials to facilitate comparison of materials that are competitive, and to make it easier for the designer to make a satisfactory material selection. Emphasis has been on quantitative information wherever possible, with a minimum of descriptive text.

Material in the book was prepared by 51 contributors, all selected with care, in order to have the information as complete and as authentic as possible. Basically all the information has been grouped into four sections covering general information on materials, metals, non-metals, and construction materials.

Handbook of Engineering Materials, edited by D. F. Miner and J. B. Seastone. Semi-stiff binding, 5½ x 8¼ in. page size, 1380 pages. Published by John Wiley & Sons, Inc., 440 4th Ave., New York, N. Y.

INSTRUMENTS FOR MEASUREMENT AND CONTROL

The most recent devices for measuring and controlling temperature, moisture, pressure, flow and uniformity are described by Werner G. Holzbock in his book, Instruments for Measurement and Control. Covered are industrial instruments commonly used for remote reading or remote automatic action within the industrial plant.

The objectives of the author are to acquaint the reader with the types of instruments available for the measurement and control of process variables; a reference book for those searching for an instrument for a specific need; to give the man who develops new instruments, an opportunity to compare the approaches used by his colleagues in the solution of problems common to the instrument industry. A special chapter on trends discusses the development of centralized systems, miniaturization and digital computers.

Chapters in the book cover temperature, humidity and moisture, pressure, flow, liquid level, density, viscosity, speed, analysis, automatic controller action, electric controllers, time function controllers, final control elements, and trends.

Instruments for Measurements and Control, by W. G. Holzbock. Cloth bound, 6 x 8¾ in., 371 pages. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

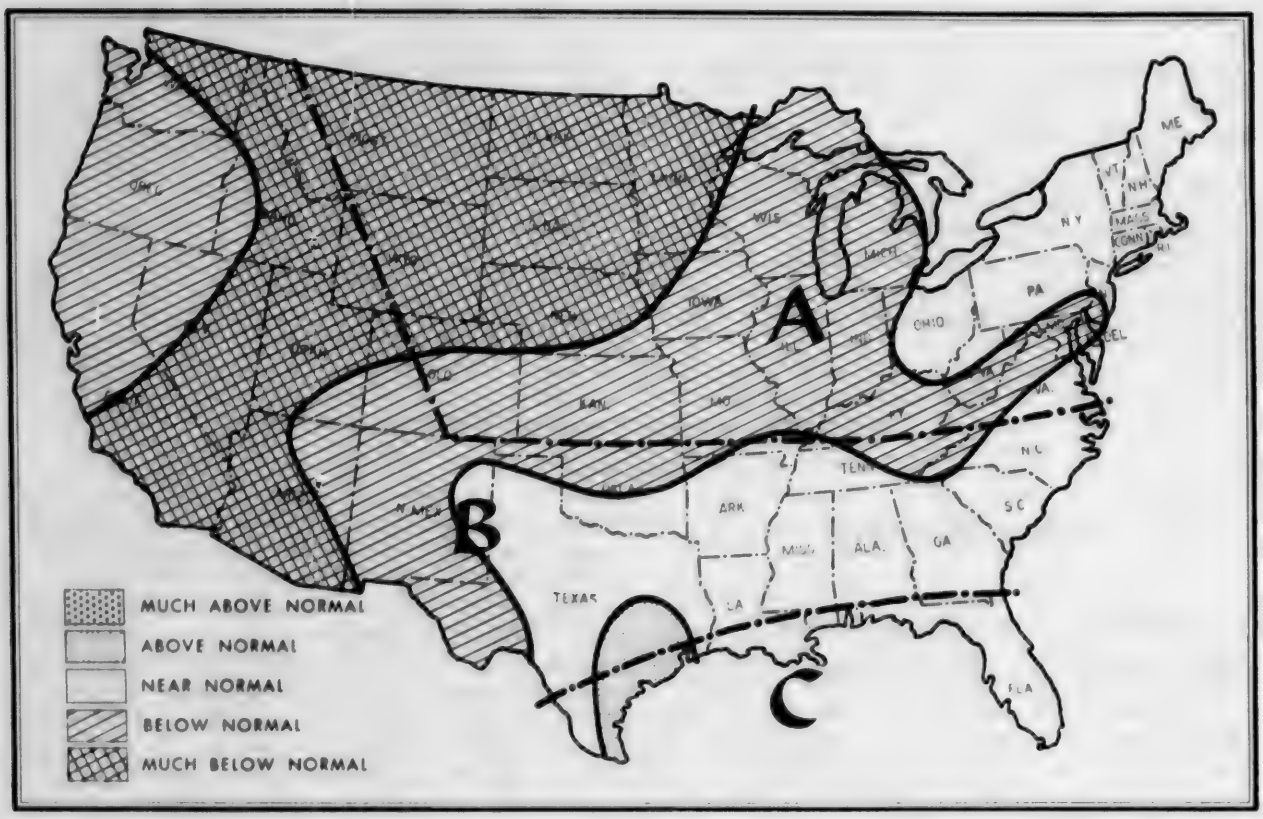
MANUFACTURERS' AGENTS

More than 8,000 manufacturers' agents in the United States, Alaska, Puerto Rico and the Hawaiian Islands are listed in the American Directory of Manufacturers' Agents. It lists the name of the agent, his location and street address but it does not indicate his sphere of interest. The publishers have had experience in compiling and publishing other directories.

Directory of American Manufacturers' Agents. Paper cover, spiral binding, 7¾ x 10¾ inches, 68 pages. Published by T. K. Sanderson Organization, 200 E. 25th St., Baltimore 18, Md. Price, $17.50.

Temperature Forecast for December

Prepared for Air Conditioning, Heating and Ventilating by Long Range Weather Consultants



KEY BY REGIONS

	A	B	C
NEAR NORMAL	+ 2° to − 2°	+ 1° to − 1°	+ 1° to − 1°
ABOVE NORMAL	+ 3° to + 5°	+ 2° to + 4°	+ 2° to + 3°
BELOW NORMAL	− 3° to − 5°	− 2° to − 4°	− 2° to − 3°
MUCH BELOW NORMAL	− 6° or more	− 5° or more	− 4° or more

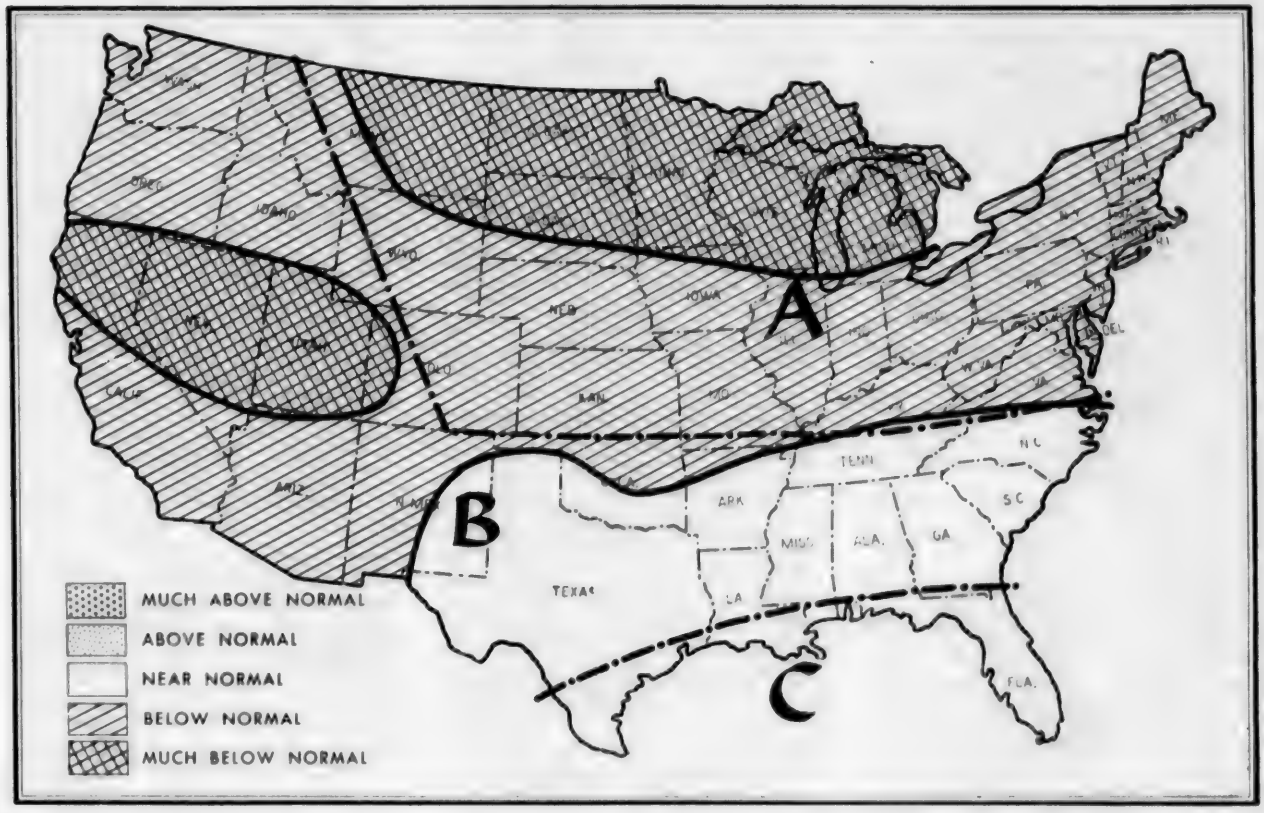
DECEMBER will be a cold month in most of the western half of the nation. Below to much below normal temperatures, generally 4° or more below the monthly normal, will prevail from the Washington and Oregon coast eastward as far as Iowa and Wisconsin. Over much of the northern Plains, from eastern Montana and Wyoming eastward through the Dakotas and northern Nebraska average departures of as much as 8 to 10 degrees below the normal may occur. The month is expected to start very cold in this region, and to moderate somewhat by Christmas time. Temperatures 3 to 5 degrees below the monthly normal are expected in most southerly sections of the country west of the Divide.

Temperatures generally close to the normal for December are expected across the southern part of the country from Texas to the Atlantic coast, with southeastern Texas averaging a couple of degrees above the normal. Temperatures moderately below normal will prevail in the upper Mississippi Valley and through the Virginias to the middle Atlantic coast. The month will average generally close to the normal temperature in the northeastern states from Ohio, Pennsylvania, Northern West Virginia, and New Jersey northeastward through New York and New England.

Temperature Forecast for Winter

A forecast for the December, January, February quarter, 1955-56

Prepared by Long Range Weather Consultants



KEY BY REGIONS

	A	B	C
NEAR NORMAL	+ 1° to − 1°	+ 1° to − 1°	+ 1° to − 1°
BELOW NORMAL	− 2° to − 4°	− 2° to − 3°	− 2°
MUCH BELOW NORMAL	− 5° or more	− 4° or more	− 3° or more

THE coming winter is expected to average below the normal temperature over most of the nation, except that generally near normal mean temperatures are indicated for southeastern and south central sections from eastern New Mexico and Texas eastward to the south Atlantic coast, where February is expected to be the only cold month.

Mean winter temperatures much below the seasonal normal are indicated for the far west from northern California eastward to the continental Divide, with below normal temperatures extending southward to the Mexican border. In this region December and February are expected to be the coldest months. The season's temperature is expected to average much below the normal also across the northern Plains from Montana eastward across the Great Lakes, with negative departures as much as 8 or 10 degrees in northernmost sections. February will be even colder than December in much of this area, but January is expected to be closer to normal.

The northeastern part of the country will have a moderately cold winter, generally 2 or 3 degrees below the normal, with the coldest weather probably occurring in February. Mean temperatures moderately below the seasonal normal are expected also in the far northwest, from Washington and Oregon eastward to the Divide, where December will be the coldest month.

Air Conditioning, Heating and Ventilating Index to Feature Articles

1950-54, inclusive.

In this index, grouped by broad subject matter and by author, only feature articles are included, excepting that Reference Data Sheets and Detail Sheets are also listed. The abbreviation *Ref. Sec.* indicates Reference Section.

An index of feature articles appearing during 1955 will be presented in next month's issue. A reprint of the accompanying index, combined with the 1955 index, will be available to subscribers on request after January 1.

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Dehumidification Cuts Comfort Conditioning Load, G. Whybrew and W. Kitchen, April, 1950, 80-81.

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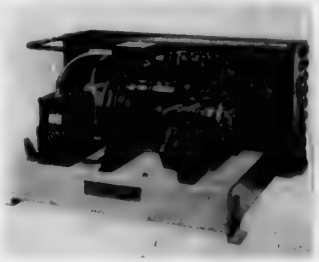
NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on page 143 for securing additional information on new equipment and materials described in this department.

Air-Cooled Condensing Units

Three air-cooled condensing units with suction-cooled motor compressors are added to the Copelametic air contioning line by Copeland Refrigeration Corp., Sidney, Ohio.



The self-contained units are being produced in 2, 3, and 5-hp sizes. They are designed for air conditioning and other high suction pressure applications.

The standard unit consists of a suction-cooled motor-compressor, a finned-tube condenser, relay box, twin fans, and a receiver mounted on a steel base. The assembly is complete with all refrigerant and electrical fittings. It is shipped dehydrated with a normal charge of factory-approved oil and a standard Freon holding charge.

Overall dimensions for the 2 and 3-hp units are: length, 40.25 in.; depth, 29.25 in.; height, 10.25 in. (2 hp) 21.25 in. (3-hp) The dimensions of the 5-hp model are: length, 45 in.; depth, 33.125 in.; and height, 27.825 in.

Specification sheets covering all models are available on request.

More information? Circle Item 1 on postcard, page 143.

Improved Sound Level Meter

A sound level meter has been improved by H. H. Scott, Inc., Cambridge, Mass. The improved model, No. 410-C, has a separate output stage for driving sound analyzers, peak noise indicators, graphic level recorders, and other accessory equipment. This removes the necessity of switching off the indicating meter movement to avoid introducing distortion caused by the rectifying action of the indicating meter.

Used for measuring noise, sound and vibration from equipment such as blowers and ventilating fans, the meter meets the specifications of the American Standards Association for sound level meters. Its sound level range is from from 34-140 db above the standard ASA reference level of 0.0002 dynes per square centimeter. It uses hearing-aid batteries with an operating life of fifty hours.

The meter is available with a range of accessories, including vibration measuring equipment, acoustic calibrator, and peak noise indicator.

More information? Circle Item 2 on postcard, page 143.

Self-Cleaning Spray Nozzles

A self-cleaning spray nozzle for central system air conditioners that will discharge lint or other fine foreign matter from its orifice is announced by Carrier Corp., Syracuse, N. Y.

Trade-named Cant-Clog, the spray nozzles will become standard equipment in the company's new spray-type air conditioners. Available in conventional sizes, they can be used to replace existing nozzles in a variety of air conditioning equipment.

If lint or other foreign material is caught behind the orifice, pressure from the water builds up within the nozzle forcing a flexible diaphragm to stretch and thereby enlarge the orifice. In the expanded position of the orifice, the restrictive particles are expelled.

Nozzles for medium pressures are made in two sizes with a low pressure cap available for the smaller model. The caps—which are that part of the nozzle containing the flexible diaphragm—will fit many existing nozzles.

More information? Circle Item 3 on postcard, page 143.

Diesel Engine Drives Welder

A diesel-powered welder for construction, pipe line, and structural welding is announced by The Lincoln Electric Co., Cleveland, Ohio.

Called the Shield-Arc SAE-250, the welder is rated for 250 amp at 40-v, on a 60% continuous duty cycle. It weighs approximately 20% less and is 1 ft shorter in length than a comparable 300-amp welder.

The machine is an addition to the company's line of dual, continuous control welders which provide regulation of both voltage and amperage throughout the output range. The type of arc can be controlled as well as the intensity to permit welding in all positions and under varying conditions of field welding. It has a range of 50 to 250 amp, handling electrodes from 1/16 to ¼-in. in diameter.

From no-load to full-rated-load, speed variation of the engine is regulated to less than 3½%. The welding generator is equipped with power outlets to provide 115-v, d-c auxiliary power for operating tools and lights.

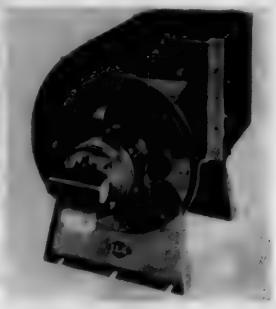
The welder is powered by a diesel engine, the DIX-4D, developed by the Hercules Motor Corp., Canton, Ohio. The motor is a 4-cylinder, 4-cycle engine with a 166 cu in. displacement, rated at 39 hp at 1700 rpm. It is equipped with a 12-v starting motor and an ether injection system for cold weather starting.

More information? Circle Item 4 on postcard, page 143.

Fan Has Airfoil Blades

Airfoil blades, with a patented design, are used for a line of centrifugal fans, Type BC, made by Ilg Electric Ventilating Co., Chicago, Ill.

The backward-curved, aluminum airfoil blade design, developed by the company, produces freedom from air flow separaration at normal working pressures. The resulting elimination of an open vortex region on the under side of the blade enables the fan wheel to develop high peak efficiencies and to operate quieter than previous designs.



The fans have sparkproof construction and non-overloading characteristics. Their construction meets requirements for both Class I and II performance, permitting operations up to a maximum tip speed of 13,500 fpm.

An overhung fan wheel provides a free inlet area, unobstructed by bearings or supports. The housings can be rotated on the job for changing the discharge arrangement when desired.

Six basic sizes comprise the line. Each size is available with direct-connected (illustrated) or belted drive. A choice of dual voltage motors in direct-connected types consists of 115/230 v, single-phase or 220/440 v, three-phase. Three housing finishes are obtainable to meet different atmospheric conditions: Corrosite, and air-dry, vinyl resin coating, for strong acid or alkali conditions; Lenkote, a baked-on Bakalite phenolin resin coating, for strong acid or alkali conditions; and Thermoplastic, for excessive moisture and mild acid conditions.

Optional fan accessories include: variable air controller, which provides air volume control for a range of conditions; a clean-out door, which is mounted in the scroll of the housing; and drains, fitted with a nipple and cap or drain cock, for the removal of water due to condensation.

More information? Circle Item 5 on postcard, page 143.

Remote or Packaged Cooler

An air conditioner for homes, stores, and small business buildings is announced by Worthington Corp., Harrison, N. J.

Known as Flexi-Cool, the unit has a cooling cycle section that may be added alone to an existing furnace. Assembled as a unit, the section can also be installed remotely with duct work extended to the conditioned area. The unit is available in 2, 3, 5, and 7½-hp sizes.

Where water is scarce, the cooling section, as a unit, may be connected to an air-cooled condenser. An installation can be made in any type home with the various sections assembled as a complete unit.

The air conditioner can be adapted to such limited space installations as crawl spaces, attics, closets, basements, and garages. It may be mounted on the floor or hung on joists from the ceiling. The sections may be arranged in various combinations to enable vertical or horizontal positioning, and the position of the air intake and delivery may be arranged accordingly.

Dimensions of the 2, 3, and 5-hp units are approximately 24 in. high, 38 in. wide, and 21 in. deep; the 7½-hp unit's dimensions are 39 x 43 x 26 in.

If a remote installation is desired, the blower and cooling coil can be installed as a unit and a water-cooled condensing unit or an air-cooled condensing unit can be installed in a remote location.

More information? Circle Item 6 on postcard, page 143.

Baseboard Enclosure

An enclosure for cast iron baseboard radiation which conceals the valve control is announced by Crane Co., Chicago, Ill. The control enclosure has a snap-on cover panel and a valve with a hinged handle that pulls to a horizontal position for adjustments, then flips to a vertical position within the enclosure.

Use of the snap-on cover eliminates screws, bulges or protruding handles. When decorating is being done, the cover can be removed for painting; subsequent removal of the cover, either for venting or adjustment of the valve, will not mar the paint job.

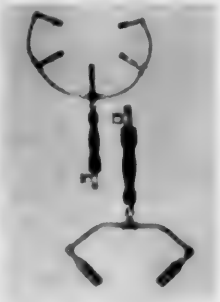
Other improvements to the company's Type RC radiant convector baseboard include the addition of new leg end sections that facilitate installation and improve appearance; a concealed intermediate support bracket that supplements leg end sections and helps carry the load of long panels; and an anchor that permanently secures the baseboard panel to the wall.

As an additional service to branches and wholesalers, baseboard sections when so specified will be assembled into panels up to a maximum of 8 lin ft at the factory at no additional charge.

More information? Circle Item 7 on postcard, page 143.

Circular Torch Burns LP-Gas

Two circular torches, designed for operation with LP-gas, are placed on the market by Mutual Liquid Gas and Equipment Co., Gardena, Calif.



The torches are used for soldering large, streamline copper pipe. They distribute heat around the entire joint in one operation, thereby reducing the heating time.

Model No. 4S has two tips and produces a broad flame, while Model No. 4B utilizes five tips and produces a pointed flame. Both torches will generate 2350 deg F in the same time. They operate on direct tank or regulated pressure, and will handle copper pipe up to 6 in. They can also be used for sweating out lead in pipe and large sewer joints.

More information? Circle Item 8 on postcard, page 143.

Saw Cuts in Cramped Spaces

A pneumatic chain saw for cutting timbers in cramped spaces is being produced by Mall Tool Co., Chicago, Ill.

Known as Model 2P18, the saw has a ⅜-in chain, and its cutting bars are available in sizes from 18 to 30 in. The saw is sufficiently light to be maneuvered with one arm.

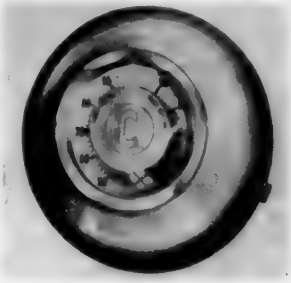
Powered by a rotary air motor that requires 46 cfm at 90 psi, the saw is classified as a high capacity, heavy duty model capable of sawing timbers up to 60 in. in diameter by cutting from both sides. It is made of aluminum and has an automatic motor oiler and a trigger throttle.

The price of the saw includes a chain repair kit, a file, assembly tools, gear lubricant, and a ⅜ in. air hose.

More information? Circle item 9 on postcard, page 143.

Round Thermostat

A round thermostat, Model TR-125, is available from Crise Controls Div., Acro Mfg. Co., Columbus, Ohio.



An enclosed snap action switch makes or breaks the circuit. No leveling is necessary.

Separate scales are provided for room temperature and temperature setting. An adjustment lever permits positive settings.

An adjustable heater covers a range of 0.35 to 1.2 amp. The cover is removable and may be painted to match the surroundings.

Two models are available, the TR-125, designed for low voltage circuits and the TR-125 M for millivolt circuits.

More information? Circle Item 10 on postcard, page 143.

Laundry Water Heater

To enable commercial laundries to increase their productive output without increasing their present boiler capacity, The Patterson-Kelley Co., Inc., East Stroudsburg, Pa., has developed a series of eight packaged storage water heaters called Steam-Mizer.

The packaged system consists of a water storage tank, a combined condensate cooling and live steam heating section, and a circulating pump, together with temperature regulator, pump controls, and other accessories.

In operation, water in the storage tank is continuously circulated by the pump through an open end shell-and-tube heat exchanger. As it circulates over the combined heating elements the water is heated by live steam in one coil and by high-pressure condensate in the other. All return high-pressure condensate from steam-operated equipment, together with condensate from the live steam coil, is passed through the condensate coil. Service water is heated while removing flash steam and cooling condensate to approximately 200 deg F before the condensate is returned to the boiler. The live steam section is used to supply the additional heat required to maintain the service water at the desired temperature.

An advantage of the system is that it permits the boiler to operate as a closed system since steam drawn from the boiler is condensed and returned as condensate. Practically no boiler water make-up is required.

Both horizontal and vertical units are available in a range of eight standard sizes to meet laundry capacities. The smallest unit can heat 870 gph of water from 40 to 180 deg F, sufficient for the needs of a laundry processing 12,000 lb of clothes per 40-hr week. The largest standard unit can heat 13,920 gph of water from 40 to 180 deg, enough for a laundry handling 192,000 lb of wash in each 40-hr week.

More information? Circle Item 11 on postcard, page 143.

Fluid Dissolves Oil Sludge

An additive for Nos. 4, 5, and 6 fuel oil that dissolves sludge is available from Stewart-Hall Chemical Corp., Mt. Vernon, N. Y.

In addition to dissolving sludge, the additive, which is called Desludgit, also breaks up oil-and-water gels and emulsifies water in the oil. The object of the additive is to keep fuel systems clean and increase the atomization efficiency of the oil.

Both non-corrosive and non-explosive in nature, the additive has a flash point of 206 deg F. It has U. S. Coast Guard certification No. 121.

A free demonstration kit is offered by the company for making tests and comparisons.

More information? Circle Item 12 on postcard, page 143.

Device Oils Threading Dies

A means of flooding dies with cutting oil while threading pipe with hand die stocks, by hand or power drive, is announced by The Ridge Tool Co., Elyria, Ohio.

Called the Ridgoilr, the device is portable and consists of a removable 15-in. wide chip pan in an oil reservoir with a carrying bail, from which a screened hose connects with a hand-operated oil pump-gun. Placed under the work, the device catches oil, chips, and cutoffs keeping floors clean, while allowing a stream of clean oil on dies, thereby cooling and protecting them.

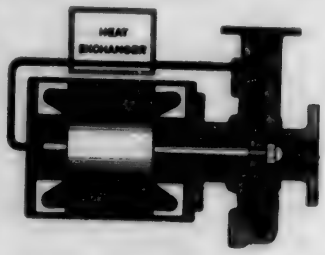
More than 95% of the oil is saved and used over and over.

More information? Circle Item 13 on postcard, page 143.

Pump Uses Heat Exchanger

A high temperature pump with an integral heat exchanger is added to the line of pumps made by Chempump Corp., Philadelphia, Pa. The new pump is designed for handling Dowtherm, Arochlor, hot fats, hot oils, and similar fluids at temperatures as high as 1000 deg F.

As with previous models, pumped fluid enters the rotor chamber of the combined motor pump. However, the necked-down area between the motor and pump sections provides both a thermal barrier and a narrow restriction for the passage of hot, pumped fluid. A secondary impeller, mounted on the rotor, circulates rotor chamber fluid through a water cooled heat exchanger mounted in the circulation line. Intermixing of hot fluid in the pump chamber and relatively cool fluid in the rotor chamber is very slight. Depending upon cooling water temperature, pumps of this design can handle fluids as hot as 1000 deg F.



Two model series have the necked-down design for high temperature work. Model CHS pumps are available in 5 and 7½-hp sizes and Model CFT units in ¾ and 1½-hp. Maximum head developed is 195 ft, and the maximum capacity is 250 gpm.

More information? Circle Item 14 on postcard, page 143.

Suspension Coupling

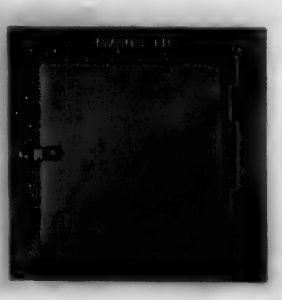
A coupling for suspension unit heaters, air conditioners, heating and air-conditioning ducts, pipes, and bus ducts is made by The Ramset Fastening System, Winchester-Western Div., Olin Mathieson Chemical Corp., Cleveland, Ohio.

Called the Drive-Thru, the coupling is used in place of the conventional threaded stud and coupling. It can be used with a ¼-in. drive pin only.

More information? Circle Item 15 on postcard, page 143.

8-Inch Cleanout Door

A steel ash pit or chimney cleanout door in the 8 x 8-in. size is announced by The Majestic Co., Inc., Huntington, Ind. Featuring a recessed door with an integral hinge, the new model, No. 80-R, is in quantity production and will be available through building supply and hardware dealers.



Formed of carbon steel, the entire door is given a green baked-enamel finish at the factory. The door itself is 8 in. square to cover a chimney access hole 7½ in. square. The door frame is over 2½ in. wide, with die-flanged edges for rigidity and a neat appearance when installed.

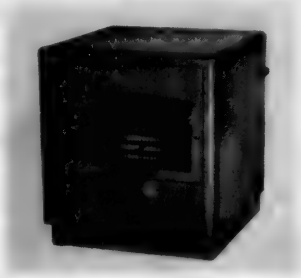
Permanently attached to the frame with an integral hinge, the access door is recessed to fit into the frame and has a latch that serves both as an opening handle and as a lock to hold the door in the closed position. Integral mortar locks serve to anchor the frame in place.

More information? Circle Item 16 on postcard, page 143.

Drum-Type Humidifier

A humidifier which can humidify areas up to 15,000 cu ft for residential, commercial, or industrial applications is manufactured by Swan Humidifier Co., Inc., Ballston Spa, N. Y.

Two sheets of vinyl plastic, 40 ft long, are rolled continuously from the center drive hub of an evaporating drum, which is 5 in. wide by 13 in. in diameter, to the outer surface. One sheet is perforated at ⅛-in. intervals, and the other is plain to avoid interlocking of the perforations. This gives an evaporating surface of 70 sq ft.



The drum rotates at 3 rpm in 4½ in. of water, giving a total of 210 sq ft of water-covered surface, over which 340 cfm of air is directed.

A molded plastic cover encloses the evaporating drum's motor and fan and funnels air from the fan through the evaporating drum. A water refilling funnel is built into the cover of portable models.

Available in both automatic and portable models, the humidifier's specifications are: 21½ in. high; 18⅜ in. wide; 21 in. deep; weight, 20 lb; grille 113⅛ x 9 in; air filter, 16 x 20 x ¼ in.; and water pan capacity, 17-qt.

The humidifier is controlled by a humidistat and is adjustable to small areas.

More information? Circle Item 17 on postcard, page 143.

Motor Is Totally Enclosed

A fractional horsepower motor is added to the line of totally-enclosed, fan cooled motors made by Century Electric Co., St. Louis, Mo. The motor is enclosed in the new re-rated frames. It is being manufactured in sizes from ½ to 100 hp for single phase and polyphase power supply.

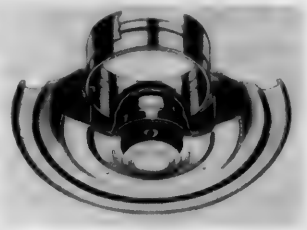
Illustrated in the photograph is the ½-hp motor which is recommended for use in dirty, dusty and fume- and mist-laden atmospheres. The motor's ventilating fan is cast integrally with the rotor and acts as a rotating seal. The aluminum rotor has skewed laminations.

Plastics and plastic coated wire are used for the stator windings. NEMA standard P and C brackets are available for bolting the motor to a machine or a machine to the motor.

More information? Circle Item 18 on postcard, page 143.

Diffuser Holds Loud-Speaker

One ceiling opening suffices for both public address or piped music system and air delivery with a new air diffuser designed by Connor Engineering Corp., Danbury, Conn., to accommodate an 8-in. high fidelity speaker. It is recommended for air terminals, plant cafeterias, manufacturing and assembly areas, and similar spaces.



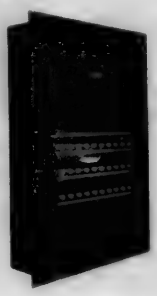
By mounting the speaker within the air diffuser, the sound source enjoys the same strategic ceiling location as the diffuser, assuring distribution of both air and sound. The air discharge does not distort the sound quality nor are the capacity and performance of the diffuser affected by the addition of the speaker housing.

The combination loud-speaker and air diffuser is available in three neck sizes, 14, 16, and 18 in., with or without a damper. Any extended range 8-in. speaker may be used.

More information? Circle Item 19 on postcard, page 143.

Electronic Control System

An electronic supervisor that follows preset programs and automatically switches on or off up to forty groups of remote operations—each on its own time schedule—has been designed by International Business Machines Corp., New York, N. Y. The control system will start and stop motors for ventilating systems, open and close valves, and control air conditioning and heating systems. A feature of the control system is that it uses carrier current signals and operates over existing electrical circuits. It does not require the installation of transmission wires. A second feature is the central operations panel (illustrated). With it a plant or school building superintendent can check on remote electrically controlled services by glancing at the indicator lights on the panel.



If it is necessary to depart from a preset program, manual operation of the control system is possible. A supervisor can break in on it at the central panel to turn on facilities for special purposes, or he can break in at the remote relay to turn on lights or to stop motors, for example, in a particular section of a building.

The basic components of the system are its central operations panel, transmitter, and coded relays. The central operations panel is the source of the system's directions. Through its relays and an electronic transmitter, pulses are sent to coded relays for the operation of electrical services, with the coded relays rejecting all pulses other than those to which they are preset to respond. In the event that it becomes necessary to expand the system, it is so designed that additional circuits, relays, and programming units may be installed at any time.

The new central control is a carrier current system which utilizes commercial 60-cycle power and lighting circuits for the transmission of its supervisory signals. The signals or pulses are superimposed on the existing circuits and do not interfere with regular electrical functions.

More information? Circle Item 20 on postcard, page 143.

Motors Are Direct-Connected

A line of horizontal motors with face type mounting brackets for direct connection to driven equipment has been developed by U. S. Electrical Motors Inc., Los Angeles, Calif. The motors are built to re-rated NEMA specifications and carry the trade name Uniclosed.

Fitted with the company's Unimount face type mounting brackets in either NEMA Style C or Style D (illustrated) specifications, the motors can be connected and automatically aligned to the driven equipment. Style C brackets accommodate bolts from the driven machine, while Style D permits bolting from the motor side. They are available in ratings from 1 to 30 hp.

The motors' integrally cast, one-piece frame is heat-treated to prevent warpage, and the windings are protected by asbestos. The split-type conduit box may be located on either side of the motor. The rotors are solid cast and dynamically balanced.

More information? Circle Item 21 on postcard, page 143.

Pump Has Vacuum Switch

A lightweight portable pump for emergency use is built by Hypro Engineering, Inc., Minneapolis, Minn. It is equipped with a vacuum switch that permits untended operation.

Weighing 26 lb with the motor, hinged carrying handle, and vacuum switch, the pump has a capacity of 5 gpm with pressures up to 30 lb. The unit can be moved from one spot to another within industrial plants whenever fast water transfer is required. The vacuum switch guards against burned out impellers by stopping the pump's motor automatically when the liquid supply runs dry.

Handling either clean or dirty water with a minimum of clogging, the pump will lift water up to 10 ft unprimed or 22 ft primed and has outside threaded ports for standard female garden hose couplings. The pump's hollow shaft slips directly on the motor shaft, eliminating the need for a base plate or coupler.

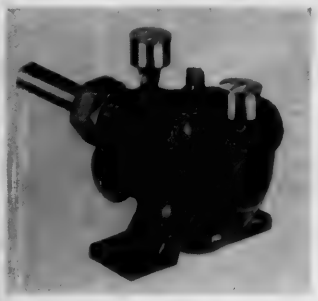
The motor is a ¼ hp, 110-v, heavy duty, capacitor type with a manual reset overload protector and a 5-ft cord.

More information? Circle Item 22 on postcard, page 143.

Pump Has Neoprene Impeller

A series of Neoprene rubber impeller pumps from ⅜ to 1¼ in. iron pipe size is introduced by American Machine Products, Inc., New York, N. Y.

Combining features of gear and centrifugal types, the pumps are intended for use where a low pressure pump is required to transfer liquids that do not affect bronze or Neoprene. They are made with pressure ranges to 30 psi, depending upon the model, and flow rates to 55 gpm.



Capable of operating in either direction at low or high speeds, the pumps are suitable on farms and in homes for draining hot water tanks and cellars; for refrigeration; and in industrial plants for coolants.

The impeller is replaceable and is keyed to the shaft. The pump itself is made entirely of bearing bronze, while the shaft is made of stainless steel. It will pass small particles of foreign matter and abrasives without jamming.

The unit is self-priming to about 15 or 20 ft when wet and should operate at the lowest speed commensurate with good delivery. Speeds range from 100 rpm to a maximum of 1750 rpm.

The pumps are supplied to operate with standard high starting torque motors from ⅓ hp and up, depending upon the model. They are available through industrial, marine and hardware distributors.

More information? Circle Item 23 on postcard, page 143.

Drills Have Longer Shanks

Longer shanks for drilling deep holes or completely through concrete are a feature of the twenty-four carbide-tipped masonry drills added to the standard line manufactured by Carboloy Dept., General Electric Co., Detroit, Mich.

The drills have butt-welded shanks of 12 and 18 in. with diameters of ¼ to 1½ in. Each is tested for heavy drilling conditions.

More information? Circle Item 24 on postcard, page 143.

Protective Safety Glasses

Safety glasses to protect workers from the danger to sight of flying objects are placed on the market by General Scientific Equipment Co., Philadelphia, Pa. The glasses weigh ¾ of an ounce and are shatterproof.

Equipped with a 6.00 base lense that is 0.050 in. thick, the glasses pass the ball drop test and are fitted with Enduron lenses.

Some of the semi-hazardous operations for which the glasses are recommended include: spot welding, buffing, woodworking, handtool operations, inspection, and the protection of prescription glasses.

The glasses are available with either clear or green tinted lenses.

More information? Circle Item 25 on postcard, page 143.

Shower Temperature Control

Protection against shower injuries due to sudden temperature change is provided by the Type H Hydroguard shower control introduced by Powers Regulator Co., Skokie, Ill. The bather has only one dial to turn, and there is only one hole in the tile wall, instead of two to four for various valves.

The thermostatic mixer used in the control safeguards against both pressure and temperature changes in water lines. A failure of either the cold or hot water supply shuts off the shower.

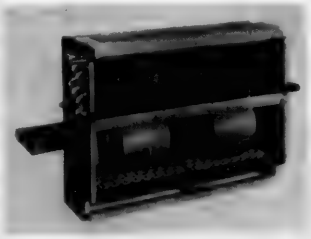
Fittings are concealed beneath the cover of the control and are accessible by removing the dial. Two types of installation are available: with concealed piping (as illustrated) or with exposed piping.

The control is suitable for use in residences, apartments, hotels, clubs, schools, industrial plants, hospital showers, and hydrotherapy. Several of the control's applications are illustrated in Bulletin 366.

More information? Circle Item 26 on postcard, page 143.

Recessed Air Conditioners

A new series, called Fedair, of recessed, remote-type air conditioning units for concealed installations is announced by Heating Div., Fedders-Quigan Corp., Trenton, N. J. The units (illustrated without front panel) are built in three sizes for multiple room installations where hot water and chilled water are available from remote sources.



Suitable for new construction in apartment house, office building, institutional, hotel and motel installations, the units are designed for heating, cooling, ventilating, circulating, filtering and dehumidifying. Dampers are provided for the introduction of outside air to be blended with recirculated air. Air is drawn off at the floor level mixed with the desired amount of fresh air and delivered into the room at window sill level.

Housed within the wall the air conditioners leave walls, corridors, and other rooms clear where traffic is heavy or space is at a premium. There is no interference with wall space or the arrangement of furniture. Roughing-in dimensions are standardized to conform with architectural and structural practice.

More information? Circle Item 27 on postcard, page 143.

Three-Way Air Valve

A 3-way solenoid pilot-operated, air valve, the S-3 Series, is offered by Airmatic Valve, Inc., Cleveland, Ohio.

Designed for application on air clutches, air brakes, power feeds, and other pneumatic equipment, the valve operates without springs and fails safe. By rotating the pilot head, the valve can be used normally open or normally closed.

The solenoid has a low amperage coil that operates on most a-c and d-c voltages (with a maximum power consumption of 10 watts) and directs two internal moving parts: the spool and solenoid plunger. It can operate continuously without harm to the solenoid or valve.

Each valve has a full pipe capacity with operating pressures ranging from 30 to 150 psi. It can be mounted in any position and has lead lengths of 24 in. All internal parts are accessible in the valve by removing a nut at the bottom of the valve assembly.

More information? Circle Item 28 on postcard, page 143.

Refractory for Brazing

A castable ceramic refractory for brazing and soldering has been developed by Technion Design & Mfg. Co., Inc., New York, N. Y.

Called Sur-Braze, the refractory can in many cases eliminate all-metal fixtures. It is suitable for symmetric tubular assemblies. Because of its low heat conductivity, it prevents fixture jamming and permits closer assembly tolerances.

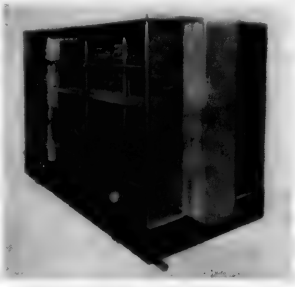
The refractory is available in standard 4 x 8 x 1¼-in. jig blocks from the company's warehouse stock. It can also be custom molded to meet special requirements. It is suitable for operating temperatures up to 1800 deg F.

More information? Circle Item 29 on postcard, page 143.

Sprayed Coil Dehumidifiers

A line of central station type sprayed coil dehumidifiers is available from American Blower Corp., Detroit, Mich.

A door on the air discharge end of the dehumidifier provides access to the coils, drain trough, and tank in that area. The coils themselves are removable from the unit either from the connection box side or from the air intake or air discharge end of the unit. The eliminators are also removable. Spray nozzles, float valve, strainer, coil face, drain troughs, and tank are accessible through the air inlet end of the dehumidifier.



The units are available in standard arrangements having 1, 2, or 3 coils high and from 4 to 8 coil rows deep. The finned tube length can vary from 2 to 10 ft; coil face area from 4 to 83 sq ft; and capacity from 2300 to 45,900 cfm. Recirculated spray water requirements for the dehumidifiers range from 5 gpm for the smallest unit in the line to 84 gpm for the largest.

Face and bypass dampers are available for the dehumidifier units as optional accessories which are mounted in a frame for bolting to the face of the air discharge. A bypass section of 18-gage galvanized steel is furnished with the dampers to be bolted to the top of the casing. Interconnecting linkage between the damper blades is provided to permit operation as a unit by the damper motor.

Two basic types of coils are available with the new units: (1) Type W water coils for use with chilled water, well water or brine and (2) Type X direct expansion coils for use with direct expanded refrigerants.

Drain troughs between the coils collect spray water from upper coil sections and return it directly to the tank through a downspout. With this arrangement, lower coils are not flooded and maximum operating efficiency is maintained. Troughs are provided on both the air intake and air discharge ends of the coils.

Spray nozzles are the self-cleaning centrifugal type. The nozzle caps are removable for cleaning.

More information? Circle Item 30 on postcard, page 143.

Salamander Is Portable

A portable salamander named Redi-Heater is being manufactured by Grimm Brooder Mfg. Co., Toms River, N. J.

Burning LP gas, the heater has a capacity of 25,000 Btu per hr. The unit is constructed of 16-gage steel, stands 16 in. high, and is 24 in. in diameter.

Among the applications of the units are their use on construction projects and as emergency heaters for schools and other institutions.

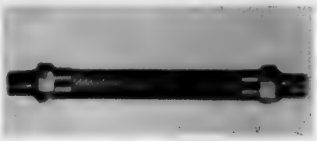
Though the heater is equipped with a 10-ft hose, connection hose is available in any desired length at slight extra cost.

More information? Circle Item 31 on postcard, page 143.

Flexible Connecting Hose

A seamless, flexible, connector for steam and hot water lines is produced by Packless Metal Hose, Inc., New Rochelle, N. Y.

Available in sizes from ¼ to 1¼-in. ID, the metal hose absorbs vibration, dampens noise due to expansion, and corrects misalignments. Available lengths of the hoses range from 7 to 28 in. overall, and recommended safe working pressures range from 1125 psi for the smaller hose to 400 psi for the larger hose.



Made with bronze braid, the hose is equipped with male fittings.

More information? Circle Item 32 on postcard, page 143.

Oil Filter Cast from Zinc

A fuel oil filter is being manufactured from zinc die-castings by Auto-Flo Corp., Detroit, Mich. The filter is designed to be installed at the oil tank or burner to remove dirt, scale, water, and other foreign matter from the line.

The oil filter's zinc die cast parts are a cylindrically shaped filter bowl and a top. The filter bowl is made of one piece and is designed with an annular section and a bolt spud cast in the rib-reinforced, inside bottom. The top has inlet and outlet ports to divert oil through the filtering element.

The ports have hexagonal extensions to accommodate a 1-in. wrench for installing oil fittings. The top aligns with a flange in the top of the bowl so that when a flange gasket is in place a good seal is obtained.

A cartridge made of felt discs and a fine mesh screen cylinder core of electro-galvanized 40 mesh wire cloth is installed in the zinc die cast bowl so that the screen fits over the bolt spud in the recessed area of the annular section, and the felt presses on top of the ring wall. To secure the two castings tightly, a cadmium plated steel retainer bolt passes through the cored hole in the cover and screws into the bolt spud in the bowl. Oil coming through the inlet port must pass through the felt discs and wire screen before it can flow to the outlet port and thence into the burner supply line.

More information? Circle Item 33 on postcard, page 143.

Individual Room Cooling

Air conditioning for multi-room structures is being manufactured by Drayer-Hanson, Inc., Los Angeles, Calif. The air conditioners have been designed for installations where low headroom, low cfm, individual-room air conditioning equipment is required, such as in hotels, motels, apartments, and offices.

Called Spotaire LRC, the air conditioners are available as basic units (illustrated) or concealed in a cabinet. The basic unit was developed for installation in new construction; the concealed type for existing construction. Cabinet model Nos. 200, 400, and 600 range in sizes from 23½ in. long x 11 in. high x 29 in. deep up to 33 in. long x 11 in. high x 29 in. deep. Nominal capacities range from 5000 Btu per hr to 24,000 Btu per hr cooling capacity and 15,000 Btu per hr to 60,000 Btu per hr heating capacity.

Only connecting link to individual units is piping for chilled or hot water, which is run from central refrigeration and heating equipment. The cabinet model is provided with holes at pipe connection points. A drain pipe hole is also provided in the cabinet. The motor requires no oiling and, aside from the usual filter cleaning, no maintenance is required.

Coils in the unit are constructed with ⅝ in. OD copper tubes, hydraulically expanded into aluminum fins for a tight bond. All structural parts are made of heavy galvanized steel. Tube sheets, drain pans, and coil baffles are made of heavy-gage aluminum. Condensation is forestalled by a coating of mastic insulation on the drain pan.

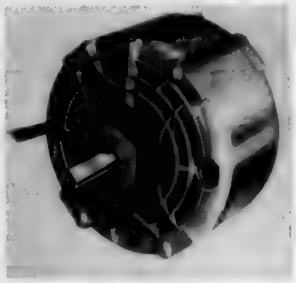
The blowers are connected directly to a rubber-mounted motor which operates at reduced speed. Vibration is minimized through the use of a ½ in. motor shaft.

Individual room control is provided by a 3-speed, wall mounted switch in each unit. Heating or cooling, ventilating or filtering are also controlled by a switch.

More information? Circle Item 34 on postcard, page 143.

Shaded Pole Motor

A shaded pole motor has been designed and is being built for air conditioning and air moving applications by The Lamb Electric Co., Kent, Ohio.



Built in sizes from 1/35 to ¼ hp, the shaded pole motor's features include: Formvar insulated wire windings; an aluminum rotor cage; die-cast end frames; widely spaced bearings; an oil reservoir; a mounting that absorbs vibration; and a moisture-resistant finish.

A folder is available describing the motor's features in detail and showing a sectional view of the motor, a performance curve, and an outline drawing with the motor's principal dimensions.

More information? Circle Item 35 on postcard, page 143.

Packing for Soot Blowers

A special packing, Cumpac Style No. 236, for soot blowers is announced by Johns-Manville, New York, N. Y. It is made of asbestos yarn braided over a plastic core of a heat resistant composition, then lubricated with mica. Or, if desired, it may be lubricated with graphite.

The design is a combination of lip-type and solid packing arranged so that the solid part takes the gland pressure. This leaves the lips free to act upon the pipe or tube. Actuated by fluid pressure, the lips provide a seal with a minimum of friction.

The packing withstands high pressure superheated steam without hardening, drying out, or vulcanizing during exposure to heat. It can also act as a bearing when that is necessary.

More information? Circle Item 36 on postcard, page 143.

Hoist Lifts Two Tons

A 2-ton winch-hoist, Model 4000, with 20 ft of cable is offered by The Lug-All Co., Haverford, Pa. It can lift, lower, or pull 2 tons a distance of 10 ft, when used double cable (as shown), or it can handle 1 ton a distance of 20 ft when used with a single cable.

The winch-hoist weighs 15 lb and has a main frame that is made of aluminum alloys, permanently lubricated bearings, stainless steel springs, three workable hooks, and a built-in pulley that can be used as a snatch block when working in close quarters.

For safety sake, the handle bends before the hoist can be overloaded in order to prevent costly accidents. An interlocking pawl system locks the load. The free release operates only under no load conditions.

The hoist can be made tamperproof by removing the reversible handle.

All units are factory tested to 100% overload and are quaranteed for one year against defective parts or workmanship, or both.

More information? Circle Item 37 on postcard, page 143.

High Velocity Fan Wheel

A pressure type blower, called Janette, is manufactured by Jan-Air, Inc., Richmond, Ill., in sizes from 6¼ to 13 in. in diameter.

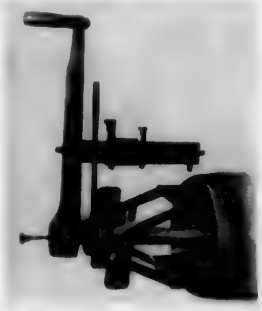
The fan wheel is one that is normally used on applications where high velocity, low volume air is required. It is also used on applications where foreign matter, such as dust, enter into the air stream and pass through the wheel without clogging the wheel.

The wheel can be constructed of cold rolled steel, stainless steel, or aluminum.

More information? Circle Item 38 on postcard, page 143.

Tool Machines Pipe Ends

A tenoning tool which makes cuts and profiles for asbestos-cement pipe installations is announced by Spring Load Mfg. Corp., Seattle, Wash.



Designated ACT-Model B, the tool machines asbestos-cement pipe ends for Ring-Tite, Simplex, and tapered couplings and for Roto-Split flanges, poured flange assemblies as well as making closures and end facings. It eliminates the need for figuring and specifying short lengths.

Changing the cam plate adapts the tool for cutting any type profile. It has an automatic feed and quick release to increase its operating speed and is sufficiently light in weight that one man can operate it on the job.

Descriptive literature and a parts and price list are available upon request.

More information? Circle Item 39 on postcard, page 143.

Hanger Rod Expansion Shield

Bottom bearing expansion shields are manufactured by Star Expansion Bolt Co., Inc., New York, N. Y., for use with hanger rods and similar suspensions where no fixture is placed against the end of the rod to provide an abutment for expanding it. The shields can be used for piping, sprinkler systems, duct work, conveyor systems, and similar installations.

Called Closin, the shields are made of rust-proofed malleable iron and are fitted with an elliptical nut which produces the expansion and does not turn in the shield. The bolt or threaded rod is inserted and travels through the nut and bears against the bottom of the shield, causing the nut to move upward with increasingly expanding force.

The expansion shields may be inserted any depth below the surface and will expand and hold as the bolt or rod is turned. No pipe sleeve or other spacer is required. They can be used to fit bolts ranging from ¼ to ¾-in. in diameter.

More information? Circle Item 40 on postcard, page 143.

Clamp Hangs Pipe

An adjustable, vibration-resistant, I-beam clamp has been designed by Globe-Cleveland Mfg. Co., Cleveland, Ohio, to handle industrial requirements for hanging piping and sprinkler systems.

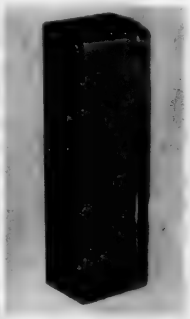
Made of 9-gage steel, the clamp has a ¾-in. opening which is adjusted to various beam dimensions by means of a cup point set screw and lock jam nut. The lower clamp body is threaded to accept a hanger rod.

Available in four sizes to take ⅜, ½, ⅝, and ¾-in. hanger rods, the clamp is used with the company's two piece split ring and clevis-type hanger.

More information? Circle Item 41 on postcard, page 143.

Baseboard Accessories

In order to simplify the installation of radiant baseboards, new unit ends and wall strips have been designed by Kritzer Radiant Coils, Chicago, Ill., for use with its K line radiant baseboard.



The unit ends snap on to the rolled front and over the top and back without the use of tools. An extension, which has a turned back lip, to the floor acts to hide the supply or return riser without requiring an additional floor plate.

Similarly, the wall strips, which are, in effect, unit ends without the solid end piece, can be used as finishing strips against the wall in a wall-to-wall installation, or as joint covers in the center of a long run. They also snap over the rolls of the front and over the back with no mechanical fastening.

More information? Circle Item 42 on postcard, page 143.

Half-Round Unit Cooler

A half-round unit cooler, designated TJ, is announced by Tenney Engineering, Inc., Union, N. J.

Available in sizes from 780 to 4050 Btu per hr, the unit cooler may be serviced by removing a single screw which releases the cover of the unit. It is a smaller model, measuring 6¾ in. high, that is suitable for small walk-in coolers, under-the-counter boxes, and bar and beverage coolers.

Four models are available with circulation capacities ranging from 165 to 400 cfm. All models have slotted hangers and snap into place on integral ceiling or back wall mounts.

More information? Circle Item 43 on postcard, page 143.

Water-Cooled Masonry Drill

A self-sharpening, diamond bit, masonry hand drill is offered by Molco Drilling Machines, Inc., Washington, D. C.

Known as the Model A-1 Hanmole, the 3200-rpm hand drill is equipped with an integral water injection system which forces water down the center of the drill bit to act as a cooling agent. Adapters allow bit size differences from ¼ to 2 in. OD. The drill operates on standard 110-v power.

The unit is designed for cutting holes in glazed tile, glazed brick, concrete, granite, marble, and other hard building materials.

Any standard faucet is adequate for the water supply. A lightweight pressure tank capable of supplying water for 30 min. of drilling is available for outside jobs.

More information? Circle Item 44 on postcard, page 143.

Moisture Barrier for Pipes

Corrugated aluminum outer jacketing, used to cover insulated pipes, is being manufactured with an inner lamination of kraft paper and polyethylene by Aljon Mfg. Co., Maspeth, N. Y.

A layer of Alathon polyethylene resin, which bonds the paper and aluminum, serves as a moisture barrier and permits the jacketing to be used in extremely wet conditions where there is danger of electrolytic corrosion of the aluminum by some insulating materials. Temperatures up to 350 deg F can be tolerated by the polyethylene laminate.

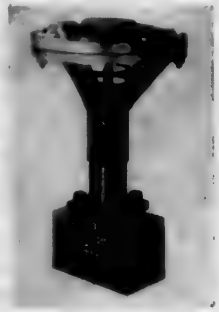
The use of polyethylene as a moisture barrier provides a light weight jacketing material with complete bonding to the aluminum and remains flexible at temperatures as low as 70 deg below zero.

Where positive vapor-seals are required, such as those in refrigeration, joints of the new Al-Cor-Jac jacketing can be sealed with pressure-sensitive tape, a lamination of aluminum foil and Mylar polyester film. The corrugated aluminum jacketing is available in 4-ft. widths and in lengths of 100 ft.

More information? Circle Item 45 on postcard, page 143.

Valve Controls Process Flow

A bellows sealed diaphragm control valve is manufactured by George W. Dahl Co., Inc., Bristol, R. I., for the control of hazardous process flows.



Assembly No. 2038, illustrated in the photograph, has a flange facing to receive a ½-in. connection and 150 lb pressure. Stainless steel material is used in the body and bonnet assembly. The valve has Teflon seating and extra packing above the bellows.

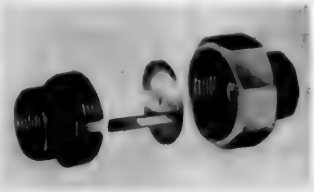
Maximum diaphragm pressure rating of the valve is 100 psig; the bellows rating is 500 psig from minus 70 to plus 700 deg F.

Air cooling fins or extended neck bonnets may be supplied with the valve. ISA face-to-face dimensions, angle or offset types with various welding, and screwed or flanged ends, are also available to specifications.

More information? Circle Item 46 on postcard, page 143.

Tab Orifice Union

A 3000-lb tab orifice union for instrumentation and process control piping is added to the line of forged steel fittings made by Watson-Stillman Fittings Div., H. K. Porter Co., Inc., Roselle, N. J. The orifice size is stamped on a tab that protrudes through a slot in the end piece of the union. The tab is an integral part of the stainless steel orifice plate.



The orifice plate may be removed when it is desired to change flow conditions. The connecting pipes need not be pulled back any farther than required to slip the plate from between the two union ends.

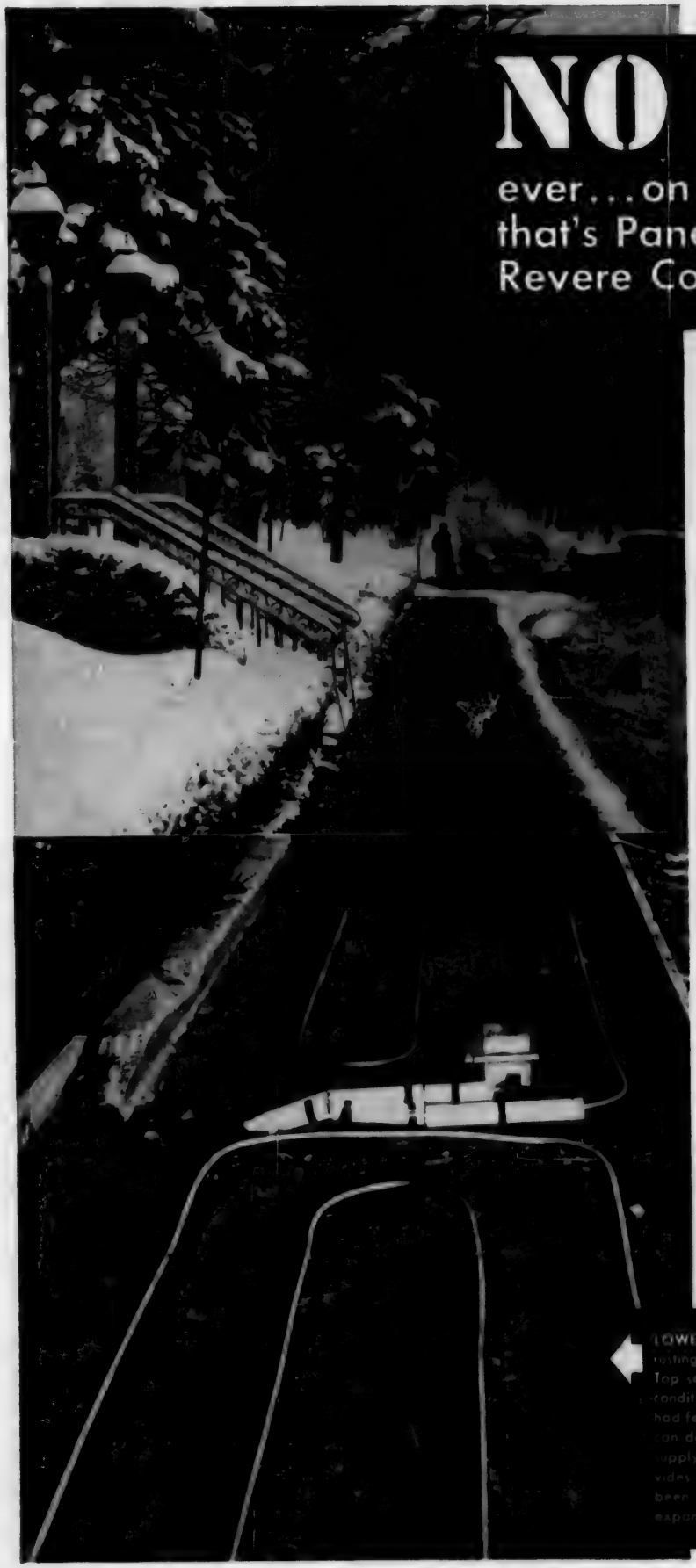
Sizes, dimensions and price information are contained in Data Sheet SU-1.

More information? Circle Item 47 on postcard, page 143.

Manufacturers' Representative

If you are seeking new lines, we suggest you register your name, territory covered, and present lines with this publication. We get numerous requests from manufacturers seeking representatives and by registering you pave the way to lining up desirable accounts. Write to the Editor, AIR CONDITIONING, HEATING AND VENTILATING, 93 Worth St., New York 13, N. Y.

(*Continued on page* 126)



NO SNOW

ever...on the sidewalk that's Panel Heated with Revere Copper Water Tube

Huge strides are being made by this method of snow removal. No wonder, shoveling and accidents due to snowy walks are eliminated . . . while the time and labor saved pays for the installation in short order.

That's why you'll find snow melting panels also being used on driveways, loading platforms, entrance aprons, service stations, pedestrian ramps at railroad stations, airports and similar spots. One application which bears special mention is the use of coils in garages. They quickly melt the snow on cars, keep floors dry as well as keep the repair shop floors warm so mechanics can lie right on the bare concrete in comfort.

And when you make the panels of Revere Copper Water Tube you have these added advantages: Copper can be bent to conform to the terrain. Bendability permits use of sinuous coils, while the 60-foot lengths of tube mean fewer fittings which, when joined by solder means joints that stay tight. Copper tube cannot rust, rot or deteriorate. That's why, on the inside, full flow and low frictional resistance are maintained throughout its long life. While external moisture will not harm it from the outside.

Keep ahead of the parade. Recommend Panel Heating for snow removal. Revere's Technical Advisory Service will be glad to help you in the proper application of Revere Copper Tube in working up your plans.

FREE! Instructive 16mm Full Color Motion Picture, "The ABC of Radiant Panel Heating." Write Advertising Department for details.

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Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

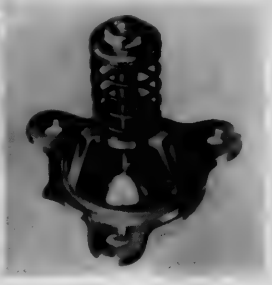
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N.Y.
Sales Offices in Principal Cities, Distributors Everywhere.

LOWER SECTION OF PHOTOGRAPH shows Revere Copper Tube was embedded in concrete slab. Top section of photo shows same walk under actual snow conditions. Note bends. Think of all the joints necessary had ferrous pipe been used. And think, too, of what seepage can do to rustable materials. Note insulation used on each supply and return line to the coils from the mains. This provides flexibility in the take-offs from the mains, which have been run below the slab, to allow for movement due to expansion and contraction.

(*Continued from page* 124)

Valve for De-Aerating Heaters

A new type of spray valve has been developed by Graver Water Conditioning Co., New York, N. Y., for use with its de-aerating heaters and hot process softeners.



The main feature of the valve is a parabolic plug which provides a constant flow angle under all conditions. By means of the plug an unvarying, even spray pattern is obtained with pressures and flow rates ranging from 3 to 150% of rating.

The valve is made of stainless steel and requires no maintenance. It is now a feature in all the company's de-aerating heaters and hot process softeners.

More information? Circle Item 48 on postcard, page 143.

Funnel-Type Floor Drain

A drain, with a funnel strainer, has been developed by Josam Mfg. Co., Michigan City, Ind., for use in floors under air conditioning units where the waste from the air conditioning unit must drain directly into the waste disposal line.

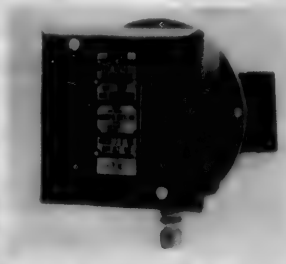
The drain is inserted so that the drain pipe from the air conditioning unit ends just above the top of the funnel, leaving an air gap between the bottom of the pipe and the top of the funnel. In the event of back flow through the floor drain, the flow will come up through the strainer portion around the funnel and cannot contaminate the drain pipe of the fixture, which drains into the funnel, because of the air gap.

Made of brass, the funnel strainer is adjustable to compensate for variations in floor thickness.

More information? Circle Item 49 on postcard, page 143.

Static Pressure Control

A static pressure control, the Cat. 114P, is added to the line of low pressure switches made by The Henry G. Dietz Co., Long Island City, N. Y.



Approved and listed by both Factory Mutual and Underwriters Laboratories, Inc., the control is designed for use as an air fuel interlock switch in packaged steam generators requiring safeguards to prevent the flow of fuel when a hazardous condition is present due to lack of forced draft. The contacts of the switch are usually wired in series with the solenoid of the oil shutoff valve. Thus, the oil valve will prevent the flow of fuel unless the blowers are supplying the proper amount of forced draft.

The control can also be used for other applications such as in forced air cooling of electronic or air conditioning equipment where blower failure would cause damage due to overheating.

The control is adjustable over a range of 0.1 to 0.5 inches of water column static pressure. The differential between cut-in pressure and cutout pressure at 0.5 inches of water column is 0.2 ± 0.05 inches of water column, and at 0.1 inches the differential is ± 0.05 inches of water column. The electrical ratings of the switch are 15 amp at 120-250 a-c and ⅛ hp or 125 volt-amperes pilot duty.

More information? Circle Item 50 on postcard, page 143.

Remote Type Air Conditioner

Remote type air conditioners, named Krack Komfort Masters, are introduced by Refrigeration Appliances, Inc., Chicago, Ill.

Three basic models are made by the company for remote type comfort cooling or heating. Though designed primarily for ceiling suspension, each unit is accessible for removing its filter when installed on the floor. They can be supplied without cabinets for furred-in installation and may be used with duct systems.

Volume control dampers and three-speed controls on the units' direct-drive centrifugal fans give a range of air velocity modulation.

The cabinets are finished in bronze baked enamel and trimmed with stainless steel. Their inside surfaces are insulated with glass fiber.

The air conditioners are available in two double-blower models with nominal capacities of 3 and 5 tons and in a single-blower model with a nominal capacity of 2 tons. A choice of coil arrangements is offered for direct expansion, water, steam, or a combination. The three-way removable filters and removable side and bottom panels of the units allow a choice of installation positions.

An illustrated bulletin giving performance tables and data is issued by the manufacturer.

More information? Circle Item 51 on postcard, page 143.

Stud-Pipe Fastener Package

In a move to simplify fastening problems, a package which will permit a ¼-in. threaded stud-pipe fastener to be used in a ⅜-in. barrel is offered by The Ramset Fastening System, Winchester-Western Div., Olin Mathieson Chemical Corp., Cleveland, Ohio. This means that much of the normal fastening in construction jobs would be possible without changing the barrel of the company's ⅜-in., powder-actuated fastening tool.

The double use of the ¼-in. fastener was made possible by replacing the ¼-in. plastic tip that is normally used with a ⅜-in. plastic tip. Then a re-useable screw-on utility driver head is supplied for use on the threaded end of the stud making the ¼-in. fastener fit into the ⅜-in. barrel.

The package contains one hundred ¼-in. fasteners fitted with ⅜-in. red plastic tips and ten re-usable utility driver heads.

More information? Circle Item 52 on postcard, page 143.

(*Concluded on page* 128)

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RIC-WIL INCORPORATED

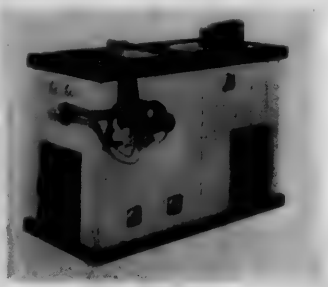
PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO

(*Concluded from page* 126)

Commercial Incinerators

Three commercial units are added to the Incinor line of domestic incinerators by Bowser, Inc., Incineration Div., Chicago, Ill.



Smokeless and odorless operation of the units is accomplished by means of a high temperature secondary combustion chamber. Controlled air is drawn in by Venturi action to attain accelerated combustion which produces the high temperatures, burns combustible gases, and eliminates odors. The design of the units allows fly ash to settle in the chamber.

Tests conducted by smoke abatement and air pollution committees, in accordance with the ASME test code for dust-separating apparatus, have been made on the new models.

The incinerators are suitable for service in factories, restaurants, schools, hospitals, bakeries, apartment houses, and similar places.

More information? Circle Item 53 on postcard, page 143.

Fuel Tank Vent Signal

A vent signal called Fil-O-Matic that whistles while a tank is being filled, and stops automatically when oil reaches the safety level, is available from A.C.E. Accessories Div., Kresno-Stam Mfg. Co., Palisades Park, N. J.

The vent signal's bypass design provides an air release that eliminates the danger of pressure-shocking tanks regardless of the pumping rate and enables the signal to operate on heavy fuel oil without being clogged up.

Two types are made by the company. Type U is specified for new installations, and Type X for old installations. An adjustable stem makes both types adaptable to either horizontal or vertical tanks.

More information? Circle Item 54 on postcard, page 143.

Cold Metal Solder

A cold metal solder is sold under the name of Lab-Metal by Alvin Products, Inc., Worcester, Mass.

An aluminum-based compound, the solder is a moldable metal in paste form. Upon drying, it hardens to form a permanent bond to metal, wood, plaster, glass, or plastic. Taking many of its characteristics from its main ingredient (aluminum pigment supplied by Aluminum Company of America), the solder forms a hard, rustproof, waterproof, metallized surface.

Applied with a putty knife, the solder repairs leaking tanks, plumbing, and gutters.

When compounded with the resin, the aluminum pigment, dries to form a surface which may be covered with paints, primers, lacquers or enamels. The solder itself may be filed, drilled, chiseled, tapped, or ground. It can also be sanded to a smooth edge.

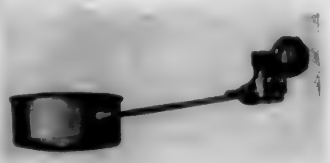
The material will withstand temperatures as high as plus 350 deg F and as low as minus 40 deg. It has a tensile strength of 650 psi and a Rockwell E. hardness between 4 and 8. It is unaffected by mild acids, alcohols, toluene, ether, petroleum, and petroleum solvents.

More information? Circle Item 55 on postcard, page 143.

Miniature Float Valve

A miniature float valve, designated RM-2, has been designed for small water controlling requirements by Robert Mfg. Co., Los Angeles, Calif.

The valve is available in two different assemblies. One the RM-2C, has a copper float; the other, RM-2S, has a styrofoam float. The capacity of the float is 1⅓ gpm at 50 psi inlet pressure.



Some of the applications of the valve listed by the manufacturer are for cooling towers or evaporative air conditioning units for processes and comfort applications, evaporative condensers, and watering troughs for poultry or rabbits.

A two-color data sheet containing specifications, dimensions, standard connections, and a list of connecting fittings for copper tube connections is available.

More information? Circle Item 56 on postcard, page 143.

Filter Protects Water Pumps

A filter for protecting water supply pumps is made by Filtros, Inc., East Rochester, N. Y.

Called Model B Flo-Clear, the filter consists of a porous ceramic cylinder held together by cast aluminum caps. It is installed by screwing it onto the end of a supply pipe where water is being pumped from a lake, stream, well, cistern, pond, or pool.

The filter will trap and filter out suspended foreign matter, such as sand, grit, gravel, algae, insects and other substances, which might damage the precision working parts of pumps. It is cleaned by reversing the direction of the flow, or by disassembling it. For convenience, a spare filter cylinder may be purchased at about half the cost of the complete filter, so that one cylinder may be used while the other is being cleaned.

Available in coarse, medium, and fine grades, the filter is suitable for home, farm, industrial and swimming pool filtering.

More information? Circle Item 57 on postcard, page 143.

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Inverted Bucket Steam Traps

Thermodynamic Steam Traps

Radiator Valves

Radiator Traps

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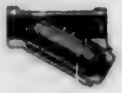


Air Eliminators

Balancing Fittings

Lift Traps

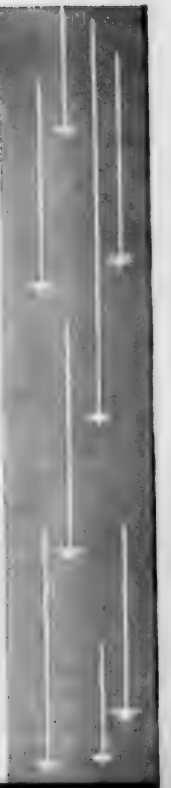
Motor Valves

Temperature Regulators

Water Blenders

Dial Thermometers

Room Thermostats



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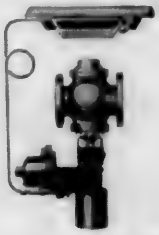

Modulating Controls for steam heating

Type AO Controls for hot water and radiant heating

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4007-B

Comparison of School Heating Systems

The results of some experiments in Great Britain on different types of school heating systems, a new chart for refrigerating compressor calculations from Italy, and use of the heat pump for supplying domestic hot water are described by our correspondent in Britain.

"THIS important paper deserves much more detailed study than I have yet been able to give it. I have carefully read it, parts of it two or three times, but I am still far from clear on several points." This, it will be allowed, is a beautifully polite way of complaining that the paper under discussion is unreadable. It is undeniably, however, an important paper. Therefore your Correspondent, like the contributor to the discussion whose words are quoted above, has struggled hard to extract the meaning from it.

The author, J. B. Dick of the Building Research Station, Watford, England, must accept these complaints as a tribute to the importance of the work which he has described. Every year sees the publication of a few papers which are just as obscure and as difficult to understand, but it is usually possible to ignore them. One cannot ignore this, which is entitled "Experimental and Field Studies of School Heating", and which appears with discussion in a recent number of the Journal of the Institution of Heating and Ventilating Engineers (Vol. **23**, p. 88).

The Importance of Being Intermittent

Over a period of two years six classrooms in a new school were heated, in pairs, by means of warm air, radiators and floor panels respectively. Temperatures were measured, automatic controls used, and fuel consumptions carefully recorded. The results are reported in the form of graphs and tables representing fuel consumption either per therm of D.H.L. (design heat load per hour) or 1000 sq. ft. of floor area. Various regimens for day and night settings of the controls were tried, and although the main text of the paper is difficult reading, the author's conclusions are clear and definite.

1. The measurements showed that with specified control settings the heat requirement for floor panels was two and a half times and for radiators twice the requirement for the warm-air systems, which were in effect providing direct intermittent heating.
2. Estimates allowing for consumption during banking of a solid fuel boiler showed that with the same control settings the requirements for floor panels and radiators would be 50% and 25% higher than that for warm-air systems.
3. It was estimated that with a common banking rate of 15% of the design rate, the requirements for radiators and warm-air systems would be similar, with that for floor panels some 15% higher.
4. It was also shown that with fully intermittent operation the requirement for the floor panel system would be some 50% higher than with a direct-heating system.

These results with the experimental school were supplemented by analyzing statistically the data obtainable on fuel consumptions in a number of schools all over Britain. A convenient method for comparison of the consumptions with different fuels and systems is to express the fuel requirement in terms of the number of therms of heat used per year divided by the therms per hour of the design heat load. This gives an answer which has the dimensions of hours per year and may be regarded as the equivalent number of hours per year at which the heating system was operated at full design rating. Unfortunately this notation is not used consistently, most of the information being given in terms of tons of coal, or units of electricity, which are not easy to compare. Another difficulty is that the data are incomplete. Schools have not been built with the most expensive methods of heating, so that some comparisons cannot be made. The only use of electrical heating in a sufficient number of cases is in floor panels operated off peak (for which a special rate for electricity is allowed in some areas). An incomplete table of comparison shows for radiators in small schools (less than 12.5 therms per hour D.H.L.) fuel consumptions as follows: coke, 2500; coal, 3200; gas, 2100; oil, 2000. For the different types of heating system there are only sufficient examples for a comparison to be made with coal as the fuel. The results are: warm air, 2400; radiators, 3200; floor panels, 3200. The comparative figure for electric floor panels is 1750.

All these figures are in therms per year per therm per hour of D.H.L., and the author suspects the installers of electric heating of calculating the D.H.L. in a different way and so arriving at a higher result (with a correspondingly lower value for annual heat consumption) than the others. This is denied by a contributor to the discussion, and the author gives calculations showing that with fully intermittent heating the equivalent therms required with electric heating might be as low as 715. Obviously off-peak heating means a waste of fuel in a building which is only occupied for a few hours from 9 a.m. daily.

Early Morning Comfort

The author was strongly attacked in the discussion on the question as to whether equivalent comfort had been achieved in the different classrooms of the experimental school. The warm-air systems, which showed the lowest fuel consumptions, undoubtedly produced cold floors and

(*Continued on page* 132)

TWENTY-FOOT LENGTHS of 10" I.D. copper tubes receive final inspection in one of the mills of The American Brass Company. ANACONDA Seamless Drawn Copper Tubes are made up to 26" I.D.

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Here's why: ANACONDA Copper Tubes are light. They come in long lengths. Smaller sizes are bent right on the job. All this means big savings on installation costs. And copper tubes can't rust. They resist corrosion and guard against contamination. Smooth interiors mean smoother flow. Pumping costs are often lower.

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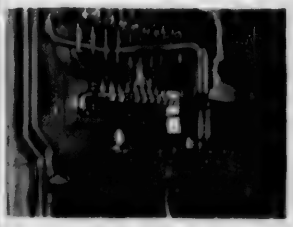

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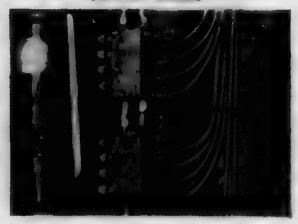

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(*Continued from page* 130)

marked temperature gradients from floor to ceiling. The tests had, in fact, included covering the floor with cork insulation in order to improve the rate of warming up of the surface. Eupatheoscopes (see *London Letter* for June, 1954) were used to determine the extent to which *equivalent temperature* differed from air temperature at the 3 ft level. For the same air temperature this showed a temperature 1½ degrees F. lower with warm-air heating than with floor panels. Not a very significant difference, said the author, who claimed that whatever the figures indicated, the same level of comfort had in fact been obtained; this had been insured by operating at or just above the "complaint level."

One contributor to the discussion thought that the floor panel system was being unnecessarily penalized by the requirement of reaching an air temperature of 62 deg. by 9 a.m. Coming in out of the cold, children and teacher would find a temperature of 50 deg quite satisfactory, provided the design figure of 62 deg was reached by about 10 a.m. It was obvious that if floor panel heating with off-peak electricity could be achieved with 1750 equivalent hours, none of the heat being available during the normal hours of occupation, there must be something amiss with a coal-fired system which needed 3200. To deduce from such evidence that floor panels need 50% more fuel than warm-air systems is stretching a point. What *has* been demonstrated is that fuel economy with floor panels and intermittent use is difficult to achieve. There is a case for insulation under the floor, and for complete shut-down from lunch time until the small hours of the following morning.

Refrigerating Compressor Calculations

The refrigeration cycle is usually represented for the purposes of description and calculation on a diagram of the Mollier type, with pressure as one axis and enthalpy or heat content as the other. The cycle consists in theory of compression at constant enthalpy, during which the pressure and temperature rise, a loss of heat at constant pressure, an expansion at constant enthalpy, and an uptake of heat again at constant pressure. So the cycle is represented by a rectangle, two sides parallel to the pressure axis and the other two parallel to the heat content axis. Temperature lines flow over the diagram according to no obvious rules and the volume lines across them almost at right angles. It is not at all clear what would happen if one changed a fundamental factor such as the temperature of evaporation and used a given machine under different conditions.

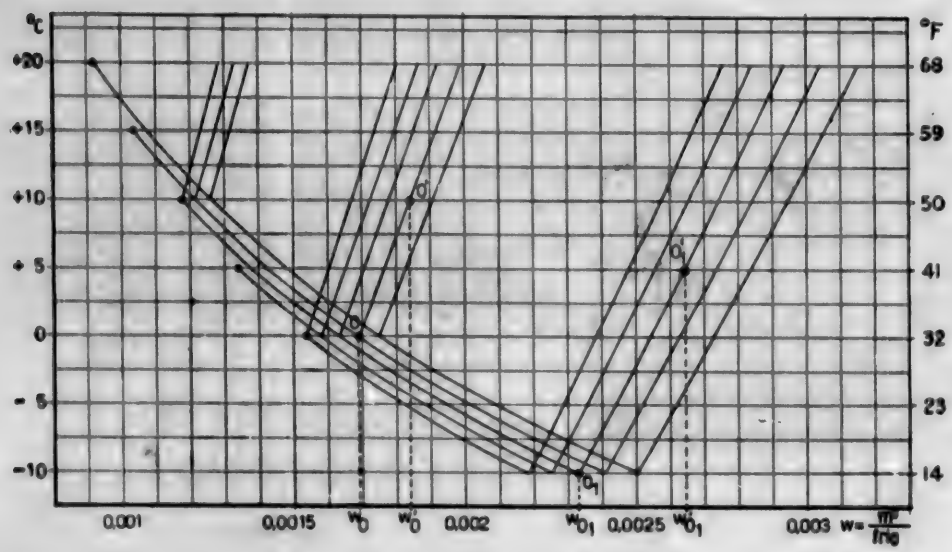
To solve such problems Dr. Ing U. Sellerio of Rome has proposed a new kind of diagram. This has temperature for the vertical axis and for the abscissa has volume of refrigerant per unit of heat transferred. By way of example a small-scale diagram of this type to illustrate the principle is given in his paper; it is reproduced here with the addition of a Fahrenheit temperature scale on the right. The abscissa is in terms of cubic metres per frigorie, which is a negative caloric; to convert to cubic feet per Btu, multiply by 8.9; alternatively one can have it in cfm per ton of refrigeration by multiplying by 1 730 so that in place of 0.001 on the diagram we would have 1.78, and in place of 0.002, 3.56 cfm per ton. This is a much more convenient range of numbers for a scale, and affords one more example of the superiority of Anglo-American units over those of the decimal system!

Each of the curves starts at its left hand end at the temperature of the liquid entering the expansion valve and at the volume of the saturated vapor at this temperature. There has to be a different curve for every such temperature, but they are all parallel because each curve represents the corresponding volume and temperature of the dry saturated vapor. The straight lines going upwards towards the right are not parallel, but all meet at absolute zero; they are lines of constant pressure and show the expansion in volume of the fluid as it takes up heat in the evaporator.

Imagine a machine working with Freon 12 entering the expansion valve at 15 C (59 deg. F), a temperature in the evaporator of 0 C (32 deg. F), and a temperature entering the compressor of 10 C (50 deg. F). It is desired to know what would be the performance at the conditions of 50, 14 and 41 deg respectively if its output was 10 tons at the higher range.

To solve this problem, select the curve starting on the

(*Concluded on page* 150)



Temperatures versus specific volume diagram for Freon 12 (from La Termotecnica).

Thousands of feet of Beth-Co-Weld Pipe are used for general-purpose piping in the Tacoma City Light Administration Building, Tacoma, Wash. *Plumbing and Heating Contractor:* Northwest Mechanical Contractors, Inc., Tacoma; *Jobber:* American Plumbing and Steam Supply Company, Tacoma.

Office Building in Tacoma...
Hospital in Greenville, S. C....
Both Have Beth-Co-Weld Piping

Beth-Co-Weld Pipe is used in the plumbing and heating lines in the Greenville General Hospital, Greenville, S. C. *Plumbing and Heating Contractor:* Wrenn Bros., Rock Hill, S. C.; *Jobber:* Noland Co., Spartanburg Branch.

In virtually any type of new structure, large or small, you'll do well to select Beth-Co-Weld steel pipe for the heating and plumbing lines, and for sprinkler installations.

Beth-Co-Weld is ideal general-purpose pipe. It is made from sound steel by the continuous-weld process, and is uniform in quality and physical properties. It is easy to cut, thread and weld.

Beth-Co-Weld comes in sizes from ½ in. to 3 in., standard-weight and extra-strong, and in 21-ft lengths, plus or minus 1 in. It is also manufactured in 3½ and 4 in., standard-weight only, in lengths of approximately 22 ft.

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BETHLEHEM STEEL

BETHLEHEM STEEL

DEGREE-DAYS FOR OCTOBER, 1955

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

AIR CONDITIONING, HEATING AND VENTILATING's 28th Year of Publication of Monthly Degree-Day Data

City	October			Season to October 31, incl.*		
	1955	1954	Normal	1955-56	1954-55	Normal
Abilene, Texas (A)	76	99	98	76	99	153
Albany, New York (A)	387	355	443	561	512	582
Albuquerque, New Mexico (A)	137	151	218	138	154	228
Alpena, Michigan (C)	431	489	530	648	694	745
Anaconda, Montana (C)	(a)	667	647**	(a)	964	982**
Asheville, North Carolina (C)	272	297	262	283	311	312
Atlanta, Georgia (A)	138	145	110	138	145	118
Atlantic City, New Jersey (C)	157	177	230	182	193	259
Augusta, Georgia (A)	138	143	59	138	143	59
Baltimore, Maryland (C)	167	177	207	191	179	236
Billings, Montana (A)	368	518	497	607	692	691
Binghamton, New York (C)	327	348	428	475	473	569
Birmingham, Alabama (A)	185	157	123	185	158	136
Bismarck, North Dakota (A)	501	626	598	753	877	825
Block Island, Rhode Island (A)	261	229	330	335	323	418
Boise, Idaho (A)	363	431	389	555	576	524
Boston, Massachusetts (A)	307	248	315	392	355	392
Bozeman, Montana (C)	(a)	647	651**	(a)	913	987**
Buffalo, New York (A)	337	357	433	474	489	555
Burlington, Iowa (A)	339	376	336	395	423	419
Burlington, Vermont (A)	435	427	521	664	651	693
Butte, Montana (C)	(a)	703	655**	(a)	1011	999**
Cairo, Illinois (C)	186	210	161	186	213	189
Charleston, South Carolina (C)	42	68	34	42	68	34
Charlotte, North Carolina (A)	155	173	147	156	173	154
Chattanooga, Tennessee (A)	230	205	169	230	208	193
Cheyenne, Wyoming (A)	470	535	577	691	667	818
Chicago, Illinois (C)	264	302	326**	298	331	402**
Cincinnati, Ohio (C)	205	256	222	212	261	264
Cleveland, Ohio (A)	320	328	340	372	373	415
Columbia, Missouri (A)	239	286	262	270	302	324
Columbia, South Carolina (A)	131	137	76	131	137	76
Columbus, Ohio (C)	294	285	299	321	308	358
Concord, New Hampshire (A)	502	418	527	712	644	719
Concordia, Kansas (C)	240	291	297	296	309	332
Dallas, Texas (A)	54	78	53	54	78	53
Dayton, Ohio (A)	315	340	324	344	371	397
Deer Lodge, Montana (C)	(a)	740	733**	(a)	1091	1132**
Denver, Colorado (A)	336	395	425	462	466	545
Des Moines, Iowa (A)	347	401	355	417	449	454
Detroit, Michigan (A)	304	350	381	397	421	477
Devils Lake, North Dakota (C)	591	658	654	916	989	930
Dodge City, Kansas (A)	190	299	262	253	314	302
Dubuque, Iowa (A)	425	467	444	529	568	593
Duluth, Minnesota (C)	610	703	614	891	1029	891
Elkins, West Virginia (A)	414	430	412	485	514	534
El Paso, Texas (A)	34	46	70	34	46	70
Ely, Nevada (A)	542	580	561	805	833	789
Escanaba, Michigan (C)	461	556	555	681	811	802
Evansville, Indiana (A)	258	289	215	264	305	274
Fort Smith, Arkansas (A)	534	619	586	765	865	801
Fort Wayne, Indiana (A)	334	380	377	398	424	484
Fort Worth, Texas (A)	55	77	58	55	77	58
Fresno, California (A)	53	82	86	54	82	86
Galveston, Texas (C)	4	19	0	4	19	0
Grand Junction, Colorado (A)	279	314	333	312	349	369
Grand Rapids, Michigan (A)	344	413	462	486	527	606
Green Bay, Wisconsin (A)	462	536	515	661	740	698
Greensboro, North Carolina (A)	230	230	202	242	234	231
Greenville, South Carolina (A)	162	166	131	163	166	141
Harrisburg, Pennsylvania (A)	257	281	308	324	321	377
Hartford, Connecticut (A)	316	309	384	436	439	485
Hatteras, North Carolina (C)	49	58	63	49	58	63
Havre, Montana (C)	498	566	564	825	805	834
Helena, Montana (A)	532	687	617	862	972	937
Houston, Texas (C)	21	30	0	21	30	0
Huron, South Dakota (A)	448	558	472	617	670	621
Indianapolis, Indiana (A)	322	343	306	351	373	385
Jackson, Mississippi (A)	135	116	69	135	116	69
Kansas City, Missouri (A)	182	247	240	200	254	284
Knoxville, Tennessee (A)	221	215	179	221	216	212
La Crosse, Wisconsin (A)	410	491	447	528	620	599

(a) Data not available.
*Heating season, cumulative, from Sept. 1.
**Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company. Tacoma figures through the courtesy of the Tacoma News Tribune.

[Table concluded on page 136]

THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa)* . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa)*.

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

With cleanability you'll sell more. Why sell less?

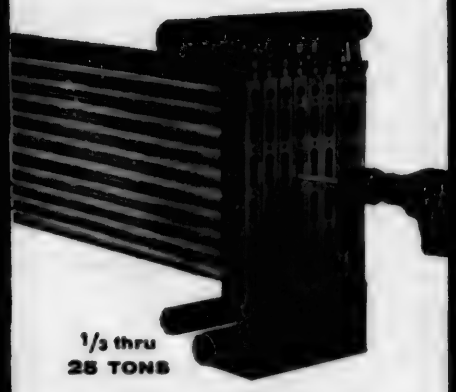
20-Year Guarantee!

on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.

2 thru 120 TONS



1/3 thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

At Leading Heating and Refrigeration Wholesalers *EVERYWHERE*

Write for Detailed Specifications

Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

DEGREE-DAYS FOR OCTOBER, 1955

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

AIR CONDITIONING, HEATING AND VENTILATING's 28th Year of Publication of Monthly Degree-Day Data

City	October			Season to October 31, incl.*		
	1955	1954	Normal	1955-56	1954-55	Normal
Abilene, Texas (A)	76	99	98	76	99	153
Albany, New York (A)	387	355	443	561	512	582
Albuquerque, New Mexico (A)	137	151	218	138	154	228
Alpena, Michigan (C)	431	489	530	648	694	745
Anaconda, Montana (C)	(a)	667	647**	(a)	964	982**
Asheville, North Carolina (C)	272	297	262	283	311	312
Atlanta, Georgia (A)	138	145	110	138	145	118
Atlantic City, New Jersey (C)	157	177	230	182	193	259
Augusta, Georgia (A)	138	143	59	138	143	59
Baltimore, Maryland (C)	167	177	207	191	179	236
Billings, Montana (A)	368	518	497	607	692	691
Binghamton, New York (C)	327	348	428	475	473	569
Birmingham, Alabama (A)	185	157	123	185	158	136
Bismarck, North Dakota (A)	501	626	598	753	877	825
Block Island, Rhode Island (A)	261	229	330	335	323	418
Boise, Idaho (A)	363	431	389	555	576	524
Boston, Massachusetts (A)	307	248	315	392	355	392
Bozeman, Montana (C)	(a)	647	651**	(a)	913	987**
Buffalo, New York (A)	337	357	433	474	489	555
Burlington, Iowa (A)	339	376	336	395	423	419
Burlington, Vermont (A)	435	427	521	664	651	693
Butte, Montana (C)	(a)	703	655**	(a)	1011	999**
Cairo, Illinois (C)	186	210	161	186	213	189
Charleston, South Carolina (C)	42	68	34	42	68	34
Charlotte, North Carolina (A)	155	173	147	156	173	154
Chattanooga, Tennessee (A)	230	205	169	230	208	193
Cheyenne, Wyoming (A)	470	535	577	691	667	818
Chicago, Illinois (C)	264	302	326**	298	331	402**
Cincinnati, Ohio (C)	205	256	222	212	261	264
Cleveland, Ohio (A)	320	328	340	372	373	415
Columbia, Missouri (A)	239	286	262	270	302	324
Columbia, South Carolina (A)	131	137	76	131	137	76
Columbus, Ohio (C)	294	285	299	321	308	358
Concord, New Hampshire (A)	502	418	527	712	644	719
Concordia, Kansas (C)	240	291	297	296	309	332
Dallas, Texas (A)	54	78	53	54	78	53
Dayton, Ohio (A)	315	340	324	344	371	397
Deer Lodge, Montana (C)	(a)	740	733**	(a)	1091	1132**
Denver, Colorado (A)	336	395	425	462	466	545
Des Moines, Iowa (A)	347	401	355	417	449	454
Detroit, Michigan (A)	304	350	381	397	421	477
Devils Lake, North Dakota (C)	591	658	654	916	989	930
Dodge City, Kansas (A)	190	299	262	253	314	302
Dubuque, Iowa (A)	425	467	444	529	568	593
Duluth, Minnesota (C)	610	703	614	891	1029	891
Elkins, West Virginia (A)	414	430	412	485	514	534
El Paso, Texas (A)	34	46	70	34	46	70
Ely, Nevada (A)	542	580	561	805	833	789
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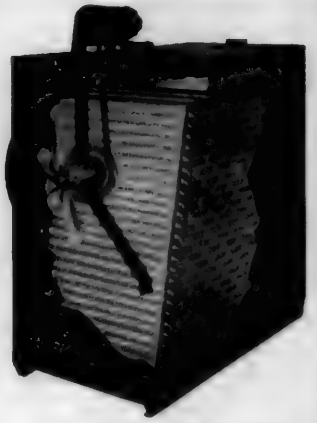
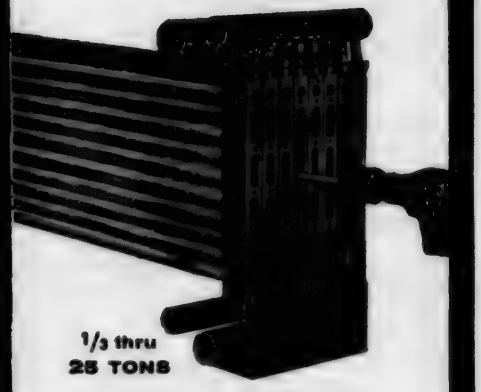


2 thru 120 TONS



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Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

Degree-Days for October, 1955 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

AIR CONDITIONING, HEATING AND VENTILATING's 28th Year of Publication of Monthly Degree-Day Data

City	October			Season to October 31, incl.*		
	1955	1954	Normal	1955-56	1954-55	Normal
Lander, Wyoming (A)	467	609	632	696	747	876
Lewiston, Maine (O)	477	437	501	676	689	666
Lincoln, Nebraska (C)	269	352	310	332	384	389
Little Rock, Arkansas (A)	124	142	110	124	142	120
Livingston, Montana (C)	(a)	641	523**	(a)	933	750**
Los Angeles, California (C)	58	30	41	64	30	58
Louisville, Kentucky (A)	230	280	232	234	293	283
Lynchburg, Virginia (A)	243	256	236	264	265	285
Macon, Georgia (A)	114	114	63	115	114	63
Madison, Wisconsin (C)	404	430	419	513	539	556
Marquette, Michigan (C)	476	596	543	736	881	779
Memphis, Tennessee (A)	158	164	126	158	164	143
Meridian, Mississippi (A)	150	135	90	150	135	90
Milwaukee, Wisconsin (A)	373	395	428	477	487	562
Minneapolis, Minnesota (A)	423	530	459	559	688	616
Moline, Illinois (A)	356	395	363	427	453	459
Montgomery, Alabama (A)	(a)	107	69	(a)	107	69
Nantucket, Massachusetts (A)	(a)	256	372	(a)	389	483
Nashville, Tennessee (A)	214	226	154	214	230	176
New Haven, Connecticut (A)	285	275	363	383	391	456
New Orleans, Louisiana (C)	14	33	5	14	33	5
New York, New York (C)	182	213	263	212	257	302
Newark, New Jersey (A)	204	234	301	249	287	348
Norfolk, Virginia (A)	122	145	152	122	149	161
North Platte, Nebraska (A)	437	498	425	589	575	545
Oak Ridge, Tennessee (C)	267	240	225	267	246	225
Oakland, California (A)	169	132	157	285	194	233
Oklahoma City, Oklahoma (A)	151	153	149	156	153	161
Omaha, Nebraska (A)	305	359	331	370	395	419
Parkersburg, West Virginia (C)	274	306	272	286	331	328
Peoria, Illinois (A)	331	344	339	372	380	425
Philadelphia, Pennsylvania (C)	156	198	219	172	216	252
Phoenix, Arizona (A)	1	14	13	1	14	13
Pittsburgh, Pennsylvania (C)	275	298	298	305	324	354
Pittsfield, Mass. (A)	473	416	543	715	662	756
Pocatello, Idaho (A)	472	568	487	692	749	670
Portland, Maine (A)	501	424	515	747	679	714
Portland, Oregon (C)	282	285	280	368	382	365
Providence, Rhode Island (A)	326	284	381	442	402	488
Pueblo, Colorado (A)	259	341	383	339	369	457
Raleigh, North Carolina (A)	191	201	118	196	202	128
Rapid City, South Dakota (A)	415	562	500	599	672	693
Reading, Pennsylvania (C)	213	252	285	269	288	342
Red Bluff, California (A)	47	68	59	50	74	59
Reno, Nevada (A)	437	470	443	636	687	608
Richmond, Virginia (A)	186	220	210	195	225	243
Rochester, New York (A)	357	359	440	525	516	573
Roswell, New Mexico (A)	134	170	156	134	170	164
Sacramento, California (C)	49	77	75	56	81	92
St. Joseph, Missouri (A)	270	291	233	304	312	282
St. Louis, Missouri (C)	215	258	202	218	269	240
Salt Lake City, Utah (A)	374	399	381	494	492	469
San Antonio, Texas (A)	28	29	25	28	29	25
San Diego, California (A)	54	35	52	55	35	76
Sandusky, Ohio (C)	290	306	327	326	334	393
San Francisco, California (C)	176	114	128	357	232	238
Sault Ste. Marie, Michigan (A)	517	622	639	851	944	937
Savannah, Georgia (A)	87	107	38	87	107	38
Scranton, Pennsylvania (A)	340	336	389	473	437	504
Seattle, Washington (C)	366	349	329	537	478	463
Sheridan, Wyoming (A)	432	589	578	676	757	817
Shreveport, Louisiana (A)	79	81	53	79	81	53
Sioux City, Iowa (A)	340	444	405	437	509	533
Spokane, Washington (A)	549	574	508	787	800	713
Springfield, Illinois (A)	310	332	259	345	365	315
Springfield, Missouri (A)	249	268	249	253	279	310
Syracuse, New York (A)	341	331	396	482	469	513
Tacoma, Washington (C)	371	379	375	555	504	552
Toledo, Ohio (A)	347	374	387	439	432	489
Topeka, Kansas (C)	207	255	242	235	268	284
Trenton, New Jersey (C)	207	244	285	259	289	340
Tulsa, Oklahoma (A)	129	135	152	129	135	170
Utica, New York (O)	370	375	430**	513	556**	612
Valentine, Nebraska (A)	430	532	461	586	646	606
Walla Walla, Washington (C)	318	389	308	444	466	401
Washington, D. C. (C)	169	218	231	182	226	263
Wichita, Kansas (A)	198	223	219	215	226	251
Williston, North Dakota (C)	518	603	605	797	907	866
Winnemucca, Nevada (A)	(a)	539	508	(a)	799	688
Yakima, Washington (A)	483	535	446	684	701	596

For footnotes, see page 134.

Blend It...
Hide It...
Combine It...

Installed as a continuous strip in window head or sill (as above), AGITAIR STRIPLINE is the only practical means for air curtaining plate glass windows or wall areas to counteract summer heat or winter chill.

AGITAIR®

STRIPLINE

DIFFUSERS

BLEND IT . . . specify AGITAIR STRIPLINE as a continuous decorative unit, or in sections to meet any requirements of interior treatment.

HIDE IT . . . in shallow lighting coves for perfect concealment.

COMBINE IT . . . with unit or continuous lighting fixtures.

AND REMEMBER . . . no matter how you use it — AGITAIR STRIPLINE diffusing vanes create maximum mixing and aspiration . . . quick temperature equalization . . . and correct air distribution over any desired length.

Every Inch a Diffuser . . . the Vanes Make the Difference

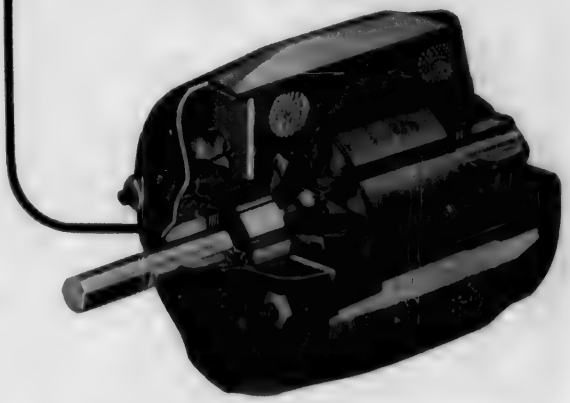
AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N. Y.

AIR DIFFUSERS • FILTERS • EXHAUSTERS

NEW, LOW COST POWER

for DOMESTIC APPLIANCES ACCESSORIES on AUTOMOBILES BOATS • AIRCRAFT



Now, power accessory manufacturers can take advantage of the low cost and extreme versatility of this new Redmond Micro-Motor. Designed for use on various domestic appliances as well as for automobile window lifts, seat adjustors, windshield wipers, air conditioners, and marine pumps and blowers, this new motor is wound for both direct and alternating current.

Major features of this new MicroMotor include the UNI-CAST field. Laminations are stacked and die cast together under pressure to eliminate shifting and vibration during motor operation. Completed core, bearings, shafting, and commutators are precision machined to assure quiet operation, long life.

The TW motor is available in sizes from 1/100th h.p. at 1500 r.p.m. to ¼ h.p. at 15,000 r.p.m. Write today for complete specifications.

ADVERTISED IN The Saturday Evening POST

The Standard of Dependability

Redmond

COMPANY, INC.

OWOSSO, MICHIGAN

REDMOND

THE **BIG** NAME IN SMALL MOTORS

NEWS OF THE MONTH

SOLAR ENGINEERING

displayed at Phoenix exhibition of devices and instruments using principles outlined at conference.

Nearly one-hundred solar-engineering displays from all parts of the world were on exhibit in conjunction with the World Symposium on Applied Solar Energy meeting in Phoenix, Arizona, (See lead article, this issue.)

Placed on the lawns of the Phoenix Civic Center, the Solar Engineering Exhibit showed working models of a 2½ horsepower sun-driven engine, a solar water heater, solar ovens and water stills

Walter T. Lucking and T. A. Phillips, president and vice president respectively, of the Arizona Public Service Company, and William Breswick, Stanford Research Institute, headed the committee responsible for the Solar Engineering Exhibit.

The work of numerous individuals and research groups shown at the exhibit included contributions from the Massachusetts Institute of Technology research program led by Hoyt C. Hottel and the University of Wisconsin research group headed by Farrington Daniels.

• **POWER.**—Among the working models at the exhibit was the 2½ horsepower solar engine manufactured in Lecco, Italy, by the Somor Co. The device, one of several solar engines to be shown, involves a flat-plate collector which uses the sun's rays to evaporate sulphur dioxide which then operates a vapor engine. The gas is condensed by a water-cooled condenser and returned to the collector in a continuous cycle.

Dr. Maria Telkes of New York University shows a solar still for salt water conversion developed for the saline water conversion program of the U. S. Department of the Interior.

Dr. and Mrs. William A. Rhodes of Questlab, Phoeniz, Ariz., demonstrate Novoid engine which produces mechanical energy directly from solar energy by boiling one end of a column of fluid to produce hydraulic thrust.

A similar one-horsepower model was purchased recently by Stanford Research Institute and has been in operation at SRI's Menlo Park laboratories. This engine was also on view at the exhibit.

Two panels with pictures of collectors and equipment built at the Solar Laboratory of the U.S.S.R. Academy of Sciences were shown. These panels were prepared by Professor V. A. Baum, eminent authority on solar energy at the Academy of Sciences of the U.S.S.R.

• **HEAT.**—On display also was a solar cooker loaned by the Goto Optical Manufacturing Company, Tokyo, Japan. This device was designed especially to cook rice. The concentrating collector surface consists of an array of small flat mirrors.

Designed to heat water in sun-abundant, fuel-scarce regions, a solar hot water system developed by Dr. E. A. Farber, University of Florida, was also on display. Sunlight penetrates the glass cover of a flat plate collector and heats the black absorbing surface. The absorber heats water which flows by thermosyphon into the storage tank ready for use.

• **HOUSES.**—Models of two solar houses were shown.

(*Continued on page* 140)

Model of a proposed solar heated house designed for the Denver area by George O. G. Lof of Denver and James M. Hunter of Boulder, Colo. Heat collector is on roof.

Why REZNOR sells 1 out of every 2 Gas Unit Heaters

Reznor leads in QUALITY

One out of every 2 ! Such complete domination of a market shared by more than 50 producers can't be an accident. Reznor achieved this leadership by building a better unit heater. An alert, aggressive product development program keeps Reznor ahead of the field. And the highest standards of craftsmanship and materials insure to every Reznor user the full advantages of Reznor's "years-ahead" engineering.

Reznor offers the best PRICE

The best heater at the lowest price? No, it isn't possible. Prices on Reznor heaters are comparable to those of the best competitive units . . . higher than those of some inferior units. But the economies of mass production enable Reznor to build a better heater for the price. Wise buyers take advantage of this to get more heater value, dollar for dollar, from Reznor than any other manufacturer can afford to offer.

Reznor is first in KNOW-HOW

Gas unit heaters are a specialty, not just a side line, with Reznor. Every emphasis is given to the development of more efficient gas-fired heaters for business and industry. This determination to do one thing well means that every possible improvement will be fully explored and exploited — never sidetracked for other projects or products.

And because Reznor sells more, many more, gas unit heaters than any other manufacturer, Reznor knows more about gas unit heating. If your Reznor representative or distributor doesn't have the answer you need, he can get it. Somebody somewhere in the Reznor organization will have the solution — proved by experience.

Reznor is tops in AVAILABILITY

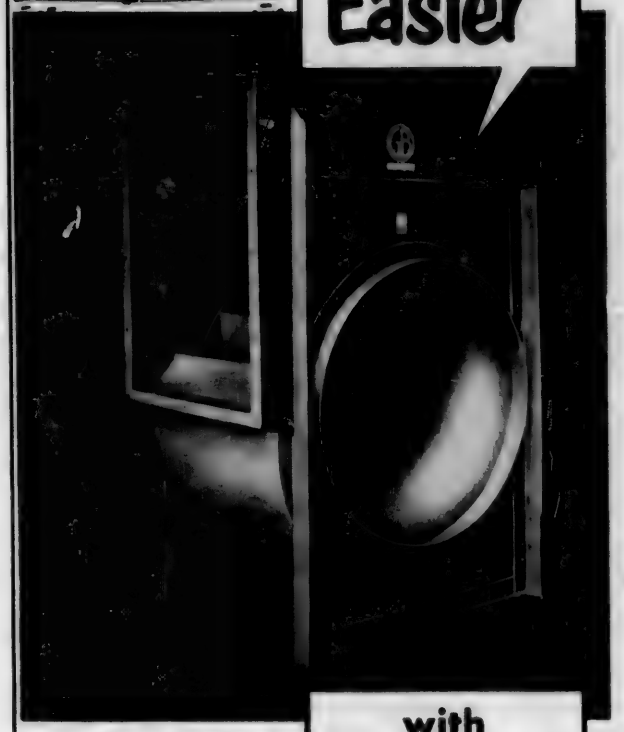
Reznor has distributors in more than 300 cities. Most of them maintain complete warehouse stocks. Wherever you are, you can be sure that the Reznor units you need will be available when and where you need them.

And wherever you are, if it's information you need, your Reznor distributor is as close as your telephone — usually for the price of a local call. If you don't find a Reznor listing under "Heaters-unit" in the classified pages of your telephone directory, please let us know. We'll give you the name and address of your nearest representative and distributor.

REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT HEATERS

Reznor Manufacturing Company 64 Union St., Mercer, Pa.

INDUSTRY Breathes Easier



Shown here is a "General" backward blade centrifugal fan. Highly flexible in purpose or position it is designed for use in heating-ventilating and air conditioning systems, power plant installations and industrial processes. Non-overloading, quiet operation are inherent qualities in all General backward blade fans.

with GENERAL mechanical lungs!

BACKWARD BLADE WHEEL AND SPUN INLET.

Greater efficiency, longer life, less maintenance cost are automatically yours in every General Blower product. Over twenty years experience in manufacturing heavy duty air moving equipment for the nation's leading industries is the guarantee of quality behind each blower leaving our plant.

Let General Blower engineering "know how" help you with your next air handling problem. Contact the engineering sales representative in your area or write General Blower Company.

GENERAL BLOWER COMPANY
8601 FERRIS AVENUE
MORTON GROVE, ILLINOIS

SOLAR ENGINEERING

(*Continued from page* 138)

These houses would derive all of their heat from the energy of the sun and store this heat throughout the day for release and circulation during the cold evenings. Various types of collectors would be used. Models of these houses were loaned by the Sun Building Company, Grand Junction, Colorado, and the American Window Glass Company, Pittsburgh, Pennsylvania.

Very high temperatures, on the order of 5400 deg F, can be obtained by concentrating sunlight with a parabolic reflector on a suitable target. Solar furnaces, as this arrangement is called, are useful for many high-temperature operations. A five-foot solar furnace was loaned by Convair, a division of General Dynamic Corporation, San Diego, California. This furnace was built from a converted 60-inch Army surplus searchlight mirror.

Also included in the exhibit was a series of eight dioramas depicting scenes of solar utilization in fancy and fact from the past and the future.

FAMILY LIFE

and health greatly improved in Air Conditioned Village, survey shows.

Sociologists of the future may credit residential air conditioning with having been as much of an influence on American living habits during the last half of the 20th Century as the automobile proved to be during the first half. This opinion is advanced by the National Warm Air Heating and Air Conditioning Association, based on reports of family experiences with air conditioning in the Austin Air Conditioned Village, Austin, Texas.

• **SOCIAL STUDY.**—Sponsored by the Research Institute of the National Association of Home Builders, the Air Conditioned Village—a 22-home community of air conditioned homes—was built in Austin, Texas, in 1954 for the purpose of research testing of air conditioning systems under actual living conditions to learn the performance characteristics of systems as well as the comfort experiences of families living with air conditioning. A team of NWAHAC field research engineers handled the testing of the system. Another team of psychologists queried village families about their summertime experiences with air conditioning and compared these experiences with those of 22 neighboring families living in non-air conditioned homes. Reports of these investigations are now being released.

In recent years, the clamor for re-establishing the family as a social unit has mounted, supported by church groups, educators, family and marriage counselors and others. The psychological studies conducted at the Air Conditioned Village indicates that the air conditioning industry may well play an important role in re-converting the residence from a base of operations back into a home.

• **FAMILIES DIFFERENT.**—Preliminary report data demonstrates that the behavior patterns of families living in air conditioned homes are markedly different from those families which are subjected to the summer-long struggle against discomforting heat and humidity conditions of non-air conditioned homes. For instance, it was found that the air conditioned families spent a significantly greater number of their waking hours together as a family group than their non-air conditioned neighbors.

Entertaining friends and relatives at home increased 300% in the case of air conditioned adult families and 400% for air conditioned families with children.

• **HEALTH.**—According to test data, air conditioning was found to dramatically affect the eating and sleeping habits of the air conditioned families as compared with their non-air conditioned neighbors. In the Air Conditioned Village, mothers were able to prepare, and appetites were able to accept, more hot meals containing 40% more energy-giving calories than meals served in non-air conditioned homes. Both adults and children in the air conditioned houses slept longer, and children took better afternoon naps.

It is interesting to note that all of the mothers in Air Conditioned Village reported that their children awoke fully rested while only 40% of the mothers in the non-air conditioned houses reported that their children rested well.

An additional interesting side-light is the fact that five of the mothers living in Air Conditioned Village specifically mentioned that their children felt a greater sense of security due to sleeping under covers while seven air conditioned families specifically mentioned looking forward to bedtime on hot summer nights.

1956 BUSINESS

to exceed records established in 1955, except in residential construction, surveyed economists say.

Business next year will be even better than this year, with greater output, higher wages and higher prices in prospect, according to the forecasts of 201 leading economists polled by F. W. Dodge Corp. in its annual survey of economists' opinion.

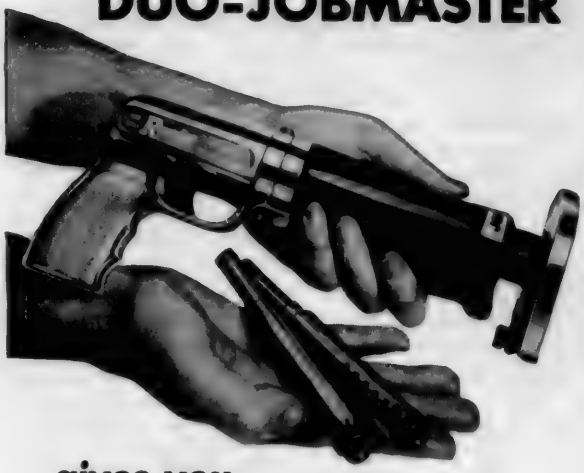
• **PEAK.**—The poll—used by the Dodge organization as one basis for its own estimates of the construction outlook to be released shortly by Dodge vice chairman Thomas S. Holden—shows the economists generally agreed that total output, measured by gross national product, will rise to a peak in the middle of 1956.

However, according to an analysis of the results by Dr. George Cline Smith, Dodge economist, the panel expects a slight downturn in output in the second half of next year. A similar pattern, he said, shows up in the forecasts for the Federal Reserve Board's index of industrial production.

In previous polls this panel accurately foresaw the mild downturn of business in 1954 and the upturn in 1955, the economists showed a high degree of unanimity on most points. For example, four out of five of the economists expect next year's gross national product to be higher than the mid-1955 level. In addition, 84% of the panel expect personal consumption expenditures next year

(*Continued on page* 142)

NEW *Ramset* DUO-JOBMASTER



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Operator carries the second barrel in his pocket like a fountain pen, ready to set any variety of fasteners the job may require—light, medium or heavy duty anchoring into hard materials like concrete or steel.

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No more drilling or chipping; fasteners are set instantly, accurately and permanently with a press of the trigger.

Learn about this low-cost, time-saving, modern way to fasten. Find for yourself what it can mean to any construction job. A demonstration will convince you.

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Get an Alnor Velometer for your air measurement needs. You'll save time and money wasted in balancing air distribution on your *next* installation. If you'd like a copy of Universal's instructions on balancing Flexiflo Diffusers with the Velometer, just send the coupon below.

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Chicago 10, Illinois

☐ Send Flexiflo Installation Manual
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Name.....
Company.....
Address.....
City.....Zone.....State.....

1956 BUSINESS

(*Continued from page* 140)

to be above prevailing levels; more than 90% expect manufacturing wage rates to increase next year; and 85% expect consumer prices to be at higher levels.

• **WHO.**—The economists participating in the current survey include 31 in financial organizations and insurance companies; 88 from other business firms; 44 from colleges and universities; and 8 from government. The remaining 30 are consultants or members of research organizations.

• **DECLINE.**—According to the analysis, the panel expects next year's total new construction to be about $41 billion, a very slight decrease below the estimate of $42 billion for this year. However, they expect housing starts to decline substantially, with a total of 1,150,000 in 1956, and with the rate in the second half of the year lower than in the first half.

MINE DRAINAGE

to be special concern of new Division of Anthracite set up in Bureau of Mines.

Secretary of the Interior Douglas McKay has announced establishment of a new Division of Anthracite in the Bureau of Mines to direct the Government's part in a $17 million cooperative State and Federal mine-drainage program in Pennsylvania's anthracite region, and to guide intensified research aimed at increasing productivity and use of hard coal.

The move places all of the Bureau's activities on anthracite, except those concerned with health and safety, under direct control of the new Division, headquarters of which will be in Washington, D. C. Chief of the Division is Joseph A. Corgan, who has headed Bureau work on hard coal and coke since 1945 and has been intimately associated with the anthracite industry's problems more than 25 years.

"The Nation's anthracite reserves present problems in conservation vastly different from those of other fuels," Secretary McKay explained. "Placing Bureau activities on this important resource under a separate division will result in easier management and permit economies in administering the new mine-drainage program."

• **DRAINAGE.**—One of the big jobs for the Division of Anthracite will be supervision of the Government's part in this anthracite mine-drainage work, scheduled to begin shortly under Public Law 162, passed by the 84th Congress. Most of this work will be handled by engineers already on the Bureau's staff, and only minor additions will be made.

The new law provides for a Federal contribution of $8,500,000, to be matched with an equal amount by the Commonwealth of Pennsylvania. Funds are to be allocated on the basis of projects approved by the Secretary of the Interior.

• **RESEARCH.**—Extremely important also, both to the anthracite region and the Nation, is the Bureau's enlarged program of research on hard coal, Bureau Director J. J. Forbes stated. This program stresses development of new and expanded uses of anthracite in the industrial market, and improvement of mining methods and equipment.

It was pointed out that recent pilot-plant experiments by the Bureau have proved that metallurgical-fuel blends containing high percentages of anthracite can be used in smelting iron ore.

Wider use of anthracite and lower mining costs will help to sustain the industry so its tremendous fuel potential would be available in a national emergency, said Director Forbes.

The urgent need for mine-drainage work cannot be overemphasized, however, he added. Without such a program, the economy of the entire anthracite region would be endangered. He cited Bureau of Mines figures showing that more than 40 tons of water are pumped for every ton of anthracite taken from deep mines.

Field headquarters for the Bureau's anthracite activities will be at the Anthracite Experiment Station, (formerly Anthracite Research Laboratory), at Schuylkill Haven, Pa.

INDUSTRIAL HYGIENE

reviewed at Foundation meeting of management, engineering, legal and chemical specialists.

Representatives of industrial management and the health professions got together on the solution to industrial health problems at the 20th Annual Meeting of Industrial Hygiene Foundation held at Mellon Institute, Pittsburgh, Pa., on November 16 and 17.

Some 700 leaders in the industries and professions from all parts of the United States sat in on technical sessions dealing with the medical, legal, engineering, chemical and toxicological phases of occupational health and attended the main gathering at which topics of general interest and concern were discussed. The 370 member companies of the Foundation were represented.

• **MANAGEMENT.**—Presenting the keynote address at the main session on November 17, A. R. Fisher, president of Johns-Manville Corp. discussed the economic aspects of industrial health. Dr. J. Roscoe Miller, president of Northwestern University, talked on graduate education for industry's professional personnel. Dr. Daniel C. Braun, medical director of Industrial Hygiene Foundation, recalled experiences accumulated in a decade of appraising industrial medical departments. Chairman of the morning session was Andrew Fletcher, president of St. Joseph Lead Co., and chairman of the board of trustees of Industrial Hygiene Foundation.

Industrial applications of atomic energy was the topic presented by Dr. W. E. Shoupp, assistant manager, Atomic Power Division, Westinghouse Electric Corp., as the first paper in the afternoon session of the management meeting. Dr. Arthur Larson, Under Secretary of Labor, spoke on current trends in workmen's compensation. The relationship of man to machines was taken up by Dr. Wilton M. Krogman, Professor of Physical Anthropology, Graduate School of Medicine, University of Pennsylvania. M. F.

(*Continued on page* 148)

ACH&V's Ad-Digest AND PRODUCT INFORMATION SERVICE

STEAM TRAPS. Inside front cover. How to select and install steam traps for lowest cost is described in two pieces of useful literature which are free on request. One is a steam trap book of data, tables, and hook-up diagrams. The other describes unit heater trapping and has Btu output tables for every model of 30 makes of unit heaters. ----------Item 81

ROOF VENTILATORS. Page 1. Centrifugal roof ventilators for quiet operation in schools and hospitals run at low speeds and move large volumes of air against static pressure. Their low silhouette blends with modern architecture. A 16-page selection catalog is available. ----------Item 82

PERIMETER HEATING. Page 2. One manufacturer's perimeter system of forced-hot water heating was economically installed in a new elementary school. Wall convectors carry forced hot water along all exposed walls. The manufacturer also makes baseboard and convector radiation for steam or hot water heating. Data is available on request.----------Item 83

THERMOSTATIC CONTROL. Page 4. In the swimming pool, locker room, and showers of the world's largest indoor swimming pool at Great Lakes Naval Training Station, one manufacturer's thermostatic controls provide water and atmospheric comfort. Among the controls used are thermostatic regulators for water heaters, thermostats, hydrostats, shower water mixers, and thermostatic controllers for showers. Engineering advice is offered. ----------Item 84

AIR CONDITIONING LINE. Page 9. The 50th anniversary of this company's air conditioning line is celebrated by making available the finest air conditioning condensing units in the company's history. The complete line includes condensing units for remote installation and package units for within-room or duct installation. ----------Item 85

PERIMETER RADIATION. Page 11. Perimeter radiation for churches, schools, hospitals, and offices is housed in a casing that fits any occasion and enhances the modern interior. Five casing styles are made, seven lengths, eight heating elements for steam or hot water, in capacities from 2.9 to 12.1 sq ft EDR. Publication is available. ----------Item 86

STEAM GENERATOR. Page 12. A 125-hp, 15-psi, oil-fired steam generator takes care of the entire heating load, including 40 unit heaters located in four buildings, of an industrial plant with a total of 91,000 sq ft of floor space. In addition, the generator heats 24,000 gal of water as high as 212 deg F. Details are available from the company's representative.----------Item 87

GALVANIZED SHEETS. Page 13. Galvanized roofing and siding sheets are manufactured by one firm in a variety of types which include steel sheets with a safety drain, V-crimp sheets, and corrugated steel. The V-crimp sheets are made with 2, 3, and 5 V-crimps, and in gages 26, 28, and 29, with a covering width of 24 in. ----------Item 88

WATER EQUIPMENT. Pages 14-15. A line of equipment used to heat, cool, and circulate water has been designed by this manufacturer to meet exacting requirements of a satisfactory water system. The line includes circulating and booster pumps, liquid coolers, and heat exchangers. Bulletins describing the equipment are available. ----------Item 89

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement.

NOTE: All advertisements are digested here except those received too late for inclusion. The Index of Advertisers lists all the advertisements in this issue.

Use the postcard below for catalogs, new equipment and materials, as well as Ad-Digest items.

STEEL PIPE. Page 16. Steel pipe was specified for the radiant heating system of a new high school because it is made by this manufacturer of the finest steel. Its quality is closely controlled from ore mine right through to the final threading operation. Information and service are available. ----------Item 90

VERTICAL PUMP. Page 17. Vertical pumps are made in either single or duplex units. The duplex units are built with either the two float switches or automatic alternator. They are available in a capacity range from 500 to 10,000 sq ft EDR and discharge pressures from 10 to 40 lb. A bulletin with engineering data and capacity tables is available ----------Item 91

FANS AND COILS. Pages 18-19. Centrifugal, utility, and propeller fans are available from this manufacturer in a variety of sizes. The coils are designed with a ridge just ahead of a row of tubes to extend turbulence over the entire fin surface for uniform heat transfer.----------Item 92

AIR CONDITIONING. Pages 20-21. This manufacturer's equipment plays a vital role in air conditioning one of the world's largest newspaper plants. A relatively high humidity must be maintained in the press room, and the heat generated by the metal pots in the stereotype section must be ventilated. In addition to equipment for complete central systems, the manufacturer also offers packaged air conditioners. ----------Item 93

AXIAL FANS. Page 22. An axial fan made by this manufacturer is an integral part of the duct in which it is installed. One can choose from a standard line of over 136 models, specially designed to meet the needs of modern industry. Bulletin is available. ----------Item 94

CAST IRON BOILERS. Page 23. Two of this manufacturer's 20-section cast iron boilers for coal burning were found after 30 years of service to be suitable for conversion to oil. The old boilers are being used along with two new boilers to heat a high school building. ----------Item 95

CENTRIFUGAL PUMPS. Page 24. A line of centrifugal pumps for air conditioning is available in a range of sizes from 1/3 to 5 hp, motor-mounted or belt-driven models. The pumps are made in two casing sizes with a bronze impeller, removable bronze wearing rings, a rotary seal, and a corrosion-resistant shaft. Capacities to 90 gpm and heads to 125 ft. Pump bulletin is available. ----------Item 96

INQUIRY CARD

Circle below item numbers on which you wish catalogs or further information.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
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157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	

PLEASE PRINT Dec. H-55

This service available only to U. S. and Canadian readers.

Name..... **Title**.....

Firm .....

Nature of Firm's Business.....

Street .....

City..... **Zone**..... **State**.....

This card is void after Mar. 1, 1956

Ad-Digest

AND PRODUCT

INFORMATION SERVICE

GALVANIZED SHEET STEEL. Page 26. Anything that can be made of steel sheets can be made with these galvanized sheets. The galvanized sheet is a soft, ductile sheet with a zinc coating that is tight enough to permit it to make anything that can be made of steel sheets. Details available. .....Item 107

CONVECTORS. Page 26. Thirty types and 5000 sizes of convectors are made by this manufacturer to meet customers' needs. Deluxe, standard, and institutional models are made along with free-standing, fully and partially recessed, concealed, and wall-hung types with many design variations. Complete details are available. .....Item 108

MAIN VENTS. Page 27. Main vents are made by this manufacturer for steam unit heaters, steam and hot water heating systems, process work, domestic water, and summer-winter units. They are designed to vent the air accumulations in the main so that the equipment will function effectively. .....Item 109

AIR CLEANER. Page 30-31. A filter curtain, consisting of a 5 ft wide by 70 ft long blanket of bonded glass fibers, compressed into a roll 12 in. in diameter, is combined with a dry type electronic filter for operations demanding super-clean air but whose locations pose a constant and costly maintenance problem. Bulletins are available. .....Item 110

SUBMERSIBLE SUMP PUMP. Page 31. A submersible sump pump for automatic submerged operation is designed with a 1/3-hp capacitor motor. It has a wall-mounted control box that can be installed in a 15 in. opening with less than 2 ft of headroom above it. It is available in capacities to 3000 gph. Bulletin is available. .....Item 111

WELDING FITTINGS AND FLANGES. Pages 33-34. Stainless steel welding fittings and flanges offer such extra values as matched pipe for calculated bursting strength; markings that permanently identify the fittings; uniform wall thickness; meet all codes; and a complete line in stock. Four analyses and four wall thicknesses are made. Dimensions and sizes of the fittings and flanges are listed by a wall chart available from the company. .....Item 112

HIGH PRESSURE AIR DIFFUSERS. Page 35. High pressure air diffusers designed to handle air at branch duct velocities up to 2000 ft per min permit the use of smaller ducts, thus reducing space requirements. Their outlets are equipped with dampers and sound traps to eliminate noise. Write on letterhead for air diffuser text book. .....Item 113

DISPOSABLE AIR FILTERS. Page 36. Available in all standard furnace and air conditioning filter sizes, the filter media of these disposable air filters is also available in bulk rolls to provide convenient and economical replacement material for commercial and industrial filtering uses. Information and prices are available. .....Item 114

PROCESSING BOILER. Page 37. By replacing outmoded equipment, one petroleum processor enjoys the benefits of automatic firing, guaranteed 80% operating efficiency, 4-pass design, forced draft, and 5 sq ft of heating surface per boiler hp. The 500-hp boiler is used for processing petroleum products and for drum washing. A catalog is available. .....Item 115

ROOF EXHAUSTERS. Page 38. Roof exhausters are used in a new TV station to keep banks of electronic tubes from melting in self-created heat. The exhausters are made in capacities from 150 to 66,000 cfm and static pressures to 4 in. .....Item 116

PACKAGED STEAM PLANT. Page 39. Packaged steam plants provide quality process steam for widely separated operations and may be set up on any floor capable of supporting their weight and put into operation within 24 hours of delivery. Fully automatic, and burning oil, gas, or both in combination, the steam generators are made in 12 sizes. Steam generator catalog is available. .....Item 117

BOILER WATER LEVEL CONTROL. Page 41. For the average school heating boiler, this company's feeder cutoff combinations add water automatically when needed to maintain a safe water level in the boiler. Pressure relief valves for hot water space heating boilers, and pump control, cutoff, and alarm switches, for boilers to 150 lb, are also made by the company. .....Item 118

AIR EXHAUSTERS. Pages 42-43. Fifty of Miami's top-flight hotels and motels choose this company's exhausters. Made of aluminum, the exhausters are produced in a wide range of sizes up to 13,000 cfm to meet most ventilating problems. Both roof and wall exhausters are available. .....Item 119

TEMPERATURE REGULATORS. Page 44. Because these temperature regulators are designed to limit steam pressures to an adjustable maximum, the need for a separate reducing valve is eliminated. One small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Bulletin is available.....Item 120

HOTEL AIR CONDITIONING. Page 45. This company's fans, air conditioning cabinets, and pumps were installed in a 450-room hotel. The fans supply the needed ventilation to the hotel's public rooms and service areas; the air conditioning cabinets provide the conditioned air for these areas, and the pumps move large quantities of chilled and hot water to the air conditioning system and power plant....Item 121

HEAT CONVERTERS. Page 46. Twenty heat converters supply sufficient heat for a housing project with 1684 apartments. Four of the five converters in each building supply 180-deg F water; the fifth supplies 200-deg water. Two catalogs are available describing the converters.....Item 122

COPPER WATER TUBE. Page 47. Copper water tube for radiant heating installation is made in long lengths of 60 and 100 feet. The tube is light in weight, can be easily bent by hand, and quickly joined with leakproof solder joint fittings. Once installed, the copper tube cannot clog with rust. .....Item 123

SHOWER MIXING VALVE. Page 48. Valves, stops and checks with strainers appear as one unit, concealed behind the dial plate yet readily accessible. The exposed parts of the shower mixing valve are finished in polished chrome; internal sliding parts are stainless steel...Item 124

REMOTE AIR CONDITIONING. Page 49. An entire medical center building is conditioned with 240 of this company's remote air conditioning units. They provide heating, cooling, and between-season circulation of filtered air. The units are individually adjustable to suit the particular area's requirements. Descriptive literature on these and other units is available. .....Item 125

SIXTEEN PAGE BULLETIN. Page 51. A 16-page bulletin has just been published by this manufacturer with complete information on remote, room air conditioning units. The bulletin includes photos, drawings, typical installation, engineering and construction details, and capacity and performance characteristics. .....Item 126

STEAM TRAPS. Page 52. The radiator traps, made by this firm, are individually and permanently adjusted to close tight on steam, but open promptly and pass air or condensate at temperatures only a few degrees below closing temperature. Their bodies are made of extra heavy cast brass that is suitable for pressures up to 125 lb of steam. A catalog of traps, packless valves, bucket traps, and venting valves is available. .....Item 127

STEAM BOILERS. Page 53. Two oil-fired steam boilers have been selected to provide a total steam capacity of 10,000 lb per hr for a sea-going radar platform. Made for industries, utilities, institutions and other users, the shop-assembled boilers are available in standard sizes for steam loads ranging from 2500 to 40,000 lb per hr at pressures to 225 psi. .....Item 128

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BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 33, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

COOLING CONTROLS. Page 54. Controls for air conditioning and refrigeration made by this manufacturer include temperature controls, automatic timers, pressure switches, high and low pressure cutouts, and solenoid starters. The controls cover a line of temperature and pressure switches for all operating requirements. .....Item 129

PLUMBING FITTINGS. Page 55. Mounting off-the-floor plumbing fixtures on behind-the-wall fittings and carriers permits a high degree of restroom sanitation to be attained and maintained in the rooms that everybody uses. All stresses are carried by the fittings and none by the wall to make it simple and easy to install, align, and replace plumbing fixtures. Booklet on restroom design is available. .....Item 130

HOTEL AIR CONDITIONING. Page 56. In 1934, this company installed air conditioning equipment in part of a Southern hotel. Two years later it installed an ice-making system, and in 1941 it installed additional cooling capacity. Seven of the company's heavy-duty compressors carry the load. Literature and estimates are offered to owners and to engineer-contractors. Three bulletins are available. .....Item 131

COPPER TUBING. Page 57. Copper tube is made by this company's specialists who make tubing and only tubing. They direct all their know-how toward the production of a better product. Everyone in the company stands ready to offer their services to architects, builders, and plumbing and heating contractors. .....Item 132

ROOM AIR CONDITIONING. Page 58. For buildings where a central air conditioning installation does not meet all the needs, one manufacturer has developed a system of individual room air conditioning that consists of units installed in the wall. Each unit can be controlled by the tenant, and there are no outside projections to mar the beauty of the building. Further details are available. .....Item 133

FAN COOLERS. Page 59. Eliminate water problems by using fan coolers for any size compressor, regardless of tonnage. Stands, hoods, and wind deflectors are available for simplified outside mounting. Bulletin available. .....Item 134

LOW VELOCITY DIFFUSERS. Page 60. Low velocity air diffusers provide concealed, draft-free air distribution in four new office buildings. The diffusers can handle 60 air changes per hour and still maintain a low rate of room air motion. Write for new literature. .....Item 135

PIPING LAYOUTS. Page 61. How to plan piping connections for a gravity feed multiple story brewery is told by one manufacturer. A complete description and enlarged diagram of the layout, which is free on request, includes additional detailed information. .....Item 136

HIGH VELOCITY AIR SYSTEMS. Page 62. Shown here are two ways of using this manufacturer's high velocity system of air distribution for heating and ventilating schools. The high velocity system can be installed by the sheet metal trades; no supply or return pipes are required. Write on business letterhead for high velocity unit selection manual. .....Item 137

STEAM TRAPS. Page 64. Steam traps are available in a wide variety of types and sizes to prevent steam waste and save fuel for low, medium, or high pressure steam or compressed air service. The traps are available from 22 in. vacuum to 600 lb pressure. Bulletins are available. ....Item 138

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

BOILER AND STEAM GENERATOR. Page 65. This one-piece unit, fire-box type, high pressure boiler is made in twelve sizes, 250 to 2500 sq ft heating surface. The packaged steam generator is completely automatic in operation, requires a vent only, and has a minimum heating surface of 5 sq ft per boiler hp. It is available in sizes from 20 to 250 hp. Bulletins on each are available. .....Item 139

RADIANT HEATING SYSTEMS. Page 66. A radiant heating system was installed in a school for cerebral palsy children. Majority of the pipe used in private rooms was ¾-in. standard and the supply mains through the hallways in sizes up to 2 in. in diameter. Steel pipe meets the requirements of such applications because of its uniform bending and strong welding properties. Bulletin on radiant heating and snow melting applications is available. .....Item 140

VENTILATION PANEL FILTER. Page 67. Ventilation panel filters are available in 2, 4, and 8-in. deep units for every type of commercial and industrial service. It operates at maximum efficiency with any medium that comes in sheet form and can be crimped. It can easily be vacuum cleaned in place. Bulletin is available. .....Item 141

PACKAGED AIR CONDITIONERS. Page 68. This company teams central and packaged air conditioners to cool a new Miami Beach hotel. The system cools 142 rooms and 186,000 cubic feet of dining and lobby space. The system includes both central and packaged air conditioners. Information available. .....Item 142

SHEET METAL EQUIPMENT. Page 69. This manufacturer's line of sheet metal equipment includes a multiple notching unit, a bench bar, and a square. The company's specialist will visit on request. .....Item 143

HOT WATER HEATING. Page 70. Automatic, gas-fired boilers for hot water heating are made by this manufacturer with inputs ranging from 850,000 to 5,200,000 Btu per hr. Made of cast iron, the boilers stand only 68 in. high and are completely enclosed in a steel jacket. More information is available. .....Item 144

IRON DRAIN PIPE. Page 71. High silicon iron pipe, made by this manufacturer, has been specified for more than 30 years by architects and engineers for corrosive waste disposal systems. Insist on the pipe for resistance to practically all commercial acids and other corrosive solutions. Bulletin is available. .....Item 145

Use this digest to locate and refer to items and advertisements appearing in this issue, then fill out and mail the prepaid postcard to request further information.

SNOW REMOVAL TUBING. Page 126. Copper water tube for snow melting panels can be bent to conform to the terrain and is available in 60-ft lengths. Copper tube cannot rust, rot, or deteriorate. Technical advisory service and a 16mm motion picture are available. .....Item 146

PREFABRICATED PIPING. Page 127. Prefabricated, insulated piping systems are made by this manufacturer for underground and overhead systems. Field service is available on all installations. An illustrated catalog is available. Item 147

COPPER TUBES. Page 131. Look into the performance advantages of this manufacturer's copper tubes before planning a new installation or replacing unsatisfactory piping. The tubes are light, they come in long lengths, smaller sizes can be bent on the job, and they are connected with solder-type fittings. Assistance in solving piping problems is offered. .....Item 148

COOLING TOWERS AND CONDENSERS. Page 132. Cooling towers, in 2 to 120-ton capacities, and water-cooled condensers, in 1/3 to 25-ton capacities, are matched to work with each other. The wetted deck surfaces of the towers carry a 25-year guarantee against rotting or fungus attack. The condenser's tubes can be cleaned by a mechanical cleaning tube. Detailed specifications are available. .....Item 149

APPLIANCE MOTORS. Page 137. Power accessory manufacturers can take advantage of the low cost and versatility of this manufacturer's new micromotor for use on various domestic appliances as well as air conditioners and marine pumps and blowers. The motor is available in sizes from 1/100 hp at 1500 rpm to ¼ hp at 15,000 rpm. Specifications are available. .....Item 150

STRIP AIR DIFFUSERS. Page 137. Installed as a continuous strip in window head or sill, a strip air diffuser is a practical means for air curtaining plate glass windows or wall areas to counteract summer heat or winter chill. Available as a continuous unit or in sections to meet interior requirements, the diffuser may be used in shallow lighting coves or with continuous lighting fixtures. ....Item 151

INQUIRY CARD

Circle below Item numbers on which you wish catalogs or further information.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
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AND PRODUCT INFORMATION SERVICE

GAS UNIT HEATERS. Page 139. Gas unit heaters are a specialty, not just a sideline, with this manufacturer who applies the economies of mass production to build a better heater. The manufacturer has distributors in more than 500 cities. Item 142

MECHANICAL LUNGS. Page 139. Highly flexible in purpose or position, this backward blade centrifugal fan is designed for use in heating, ventilating, and air conditioning systems, power plant installations, and industrial processes. ....Item 143

AIR VELOCITY METER. Page 141. An instantaneous, direct reading air velocity meter is accurate in all ranges, compact, portable, and easy to understand and use. A wide assortment of jets and fittings make the instrument suited for all air velocity measurement. Instructions on balancing air diffusers are available. .....Item 144

POWERED FASTENERS. Page 141. A new power-actuated fastener has interchangeable barrels to set either ¼ or ⅜-in. fasteners into steel or concrete. The operator carries the second barrel in his pocket like a fountain pen. .....Item 145

LIQUID GRILLERS. Page 147. The two 150-ton air conditioning units in New York's glass bank are equipped with this manufacturer's dry expansion Freon chillers. The chillers each supply blowers with 281 gpm of water, chilled from 50 to 40 deg F. A catalog containing information on the units is available. ....Item 146

GAGE AND CONTROL CATALOG. Page 146. A 72-page gage and control catalog tells where to use them, why, and how. It illustrates instruments and gages for the efficient measurement of combustion, draft, pressure, and others. Diagrams of installations and charts of performance data are also included. Send for free copy. .....Item 147

THIN CORE GRILLES. Page 149. Grilles designed specifically for thin doors and partitions from ¼ to ⅝-in. thick do not require the addition of wood moldings. They have a telescoping auxiliary frame that fastens to the grille with posts and screws. A catalog listing over 1000 types and sizes of grilles is available. Item 148

VALVES AND FITTINGS. Page 149. Circulator valves which close in ¼ turn are made in straightway and angle pattern, thread or sweat connections, for 60 psi. Balancing fittings have a sloping seat that modulates flow from full open to any degree of closure. Line also includes vent tees, union elbows, and connectors. Hot water bulletin and consumer booklet are available. .....Item 150

CONDENSERS. Page 150. For large refrigeration systems, this manufacturer offers a choice between a battery of condensers or a high capacity condenser that saves space. Both remove superheat and keep the system free of oil. A wet bulb control automatically gives low head pressure operation. Bulletin is available. .....Item 150

CABINET UNIT HEATERS. Page 151. Thorough engineering research preceded the manufacture of these cabinet unit heaters. Alternative features and designs were analyzed from the standpoint of proved practicality and efficiency. Complete information on the cabinet unit heaters is available. .....Item 151

VANE RUNNERS. Page 152. Vane runners for installing single or double blade turning vanes in square elbows are now available in coils. Coiled in 100-ft lengths, each coil weighs approximately 50 lb and is packed in a box 28 x 28 x 5 in. Vane runner metal emerges from the box at bench height. Catalog and specification sheet are available. .....Item 152

HEAT EXCHANGERS. Page 153. One of the thousands of custom-made heat exchangers that this manufacturer builds for industrial needs is a 12,000-cfm direct fired air preheater. The stainless steel combustion chamber sets below the tube banks, and air exit temperature is 1000 deg F. .....Item 153

FIRE EQUIPMENT. Page 156. It pays to figure on this manufacturer's line of interior fire protection equipment. It is a full line made to meet every specification and other needs. .....Item 154

OIL UNIT HEATERS. Page 157. An oil-fired unit heater was suspended in each corner of an indoor swimming pool overhead and out of the way. The units need no boiler or chimney, and there are no pipes, valves, and fittings to mar the view. This is only one of hundreds of jobs that this company's unit heaters can do. Catalog is available. .....Item 155

REFRIGERANT INDICATORS. Page 157. Advance design of these refrigerant indicators, which use a sight glass, keeps refrigerant losses to a minimum. Engineers dealing with fluid flow problems associate the name of these indicators with engineering assistance. A company representative will help in the choice of an indicator. Send for catalog. .....Item 156

AIR FILTERS. Page 157. No filter does all jobs, meets every need. That's why this company's filters are engineered to the job to offer more effective dust collection. This company's expanded metal face plate nets as a lint arrestor to provide easier cleaning and surfacing. It distributes air easily over the entire filter area. Bulletin available. .....Item 157

AUTOMATIC BOILER. Page 158. Accessibility is built into this automatic boiler. Used for high or low pressure steam and for hot water applications, the packaged steam generator has a range from 30 to 800 hp and can be gas, oil, or combination fired. Bulletins are available. Item 158

STEAM-DISTRIBUTING TUBES. Page 159. Trombone-shaped steam distributing tubes provide uniform final temperatures and positive freeze protection for heating and ventilating applications with modulating valve control. Each tube serves two adjacent condensing tubes from a single supply header connection. Publication is available. .....Item 159

VERTICAL DISCHARGE FAN. Page 160. A vertical discharge fan can remove a large volume of fumes or air at high velocity. The fan is fabricated of zinc-coated iron sheet with welded construction throughout. Available as direct drive with motor mounted inside air stream or with motor mounted outside throat of ventilator. Catalog available. ....Item 170

AIR VENTS. Page 160. Air vent valves to handle the toughest venting job include one model that gets heat fast to hard-to-heat radiators and another main line vent that eliminates air faster from main and risers. Detailed literature is available. .....Item 171

CUTOFF SWITCHES. Page 160. Low draft and low pressure cutoff switches are single purpose switches that monitor positive or negative air pressures. They are adjustable over a wide range and actuate a snap action switch on a fixed differential of 0.02 in. of water. Application information is available. .....Item 172

FLUE GAS ANALYZER. Page 160. A portable flue gas analyzer will speed up the final setting of burners. Find out how to check a furnace for maximum efficiency. Information is available. .....Item 173

AIR CONDITIONING ENGINEER. Page 161. An unusual opportunity exists as manager of air conditioning product engineering in the research laboratories of an outstanding corporation. Compensation is in the low five figures with excellent prospects for financial advancement. Please submit detailed resume. ...Item 174

HEATING SPECIALTIES. Page 162. A line of heating specialties includes pressure safety relief valves, feed water pressure regulators. Boiler water level controls for low pressure steam heating boilers are also made along with other protective and control devices. .....Item 175

SERVICE MANUAL. Inside back cover. A 72-page service manual containing material adaptable to air handling or conditioning jobs includes a 24-page section covering a new line of sprayed coil equipment designed for cooling and dehumidifying service in central station air conditioning systems. Copies of the catalog are available. .....Item 176

CONTROL PROBLEMS. Back cover. Dependable control of temperatures and humidities is essential in the operation of a gravure plant. This manufacturer's controls system, in command of 25 central heating, ventilating, and air conditioning systems, solves the control problem with precision. An engineer from the manufacturer's nearby branch will gladly give recommendations without obligation. .....Item 177

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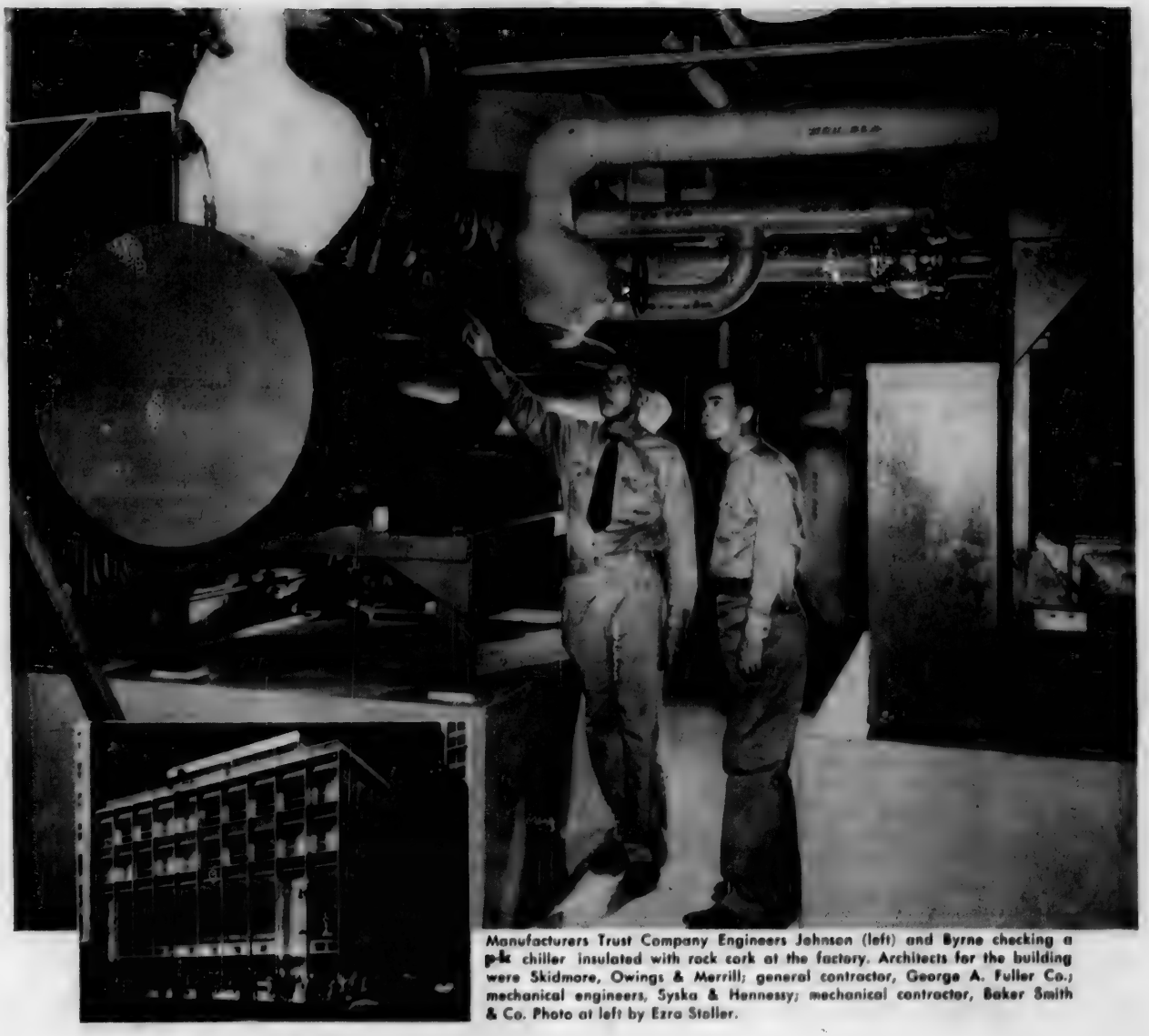

Manufacturers Trust Company Engineers Johnson (left) and Byrne checking a p-k chiller insulated with rock cork at the factory. Architects for the building were Skidmore, Owings & Merrill; general contractor, George A. Fuller Co.; mechanical engineers, Syska & Hennessy; mechanical contractor, Baker Smith & Co. Photo at left by Ezra Stoller.

Worthington relies on p-k chillers in the world's most distinctive bank building

When this "house of glass" opened at the corner of Fifth Ave. and 43rd Street in New York last year, 40,000 visitors came to take a look. Small wonder! For in this newest and largest branch of Manufacturers Trust Company, they saw architectural history being made.

No longer are bank tellers "caged." Customers transact their business in a new atmosphere of space, light and friendliness.

Contributing to this feeling of unhurried friendliness are two 150-ton Worthington air conditioning units, each equipped with a p-k dry expansion Freon chiller. This super-efficient system "reconditions" all five stories of the building every three to five minutes with 97,000 cu. ft. of fresh, low-humidity, 74 F air. It's automatic, too, shutting down by itself at 11 P.M. and starting again at 6 A.M., to assure a comfortable working climate for the bank's 280 employees – and their customers – at the start of each day.

Teamed up with Worthington's famous "million dollar" compressors, p-k chillers each supply blowers with 331 gallons of water per minute, chilled from 50 F to 40 F.

For full information on these complete units write Worthington Corp., Dept. PK, Harrison, N. J. today. Or write for Catalog 101 on p-k chillers to The Patterson-Kelley Co., Inc., 1020 Burson Street, East Stroudsburg, Pa., and principal cities.

PATTERSON-KELLEY

2570

Flooded and Dry Expansion Type Freon Coolers and Storage Water Coolers • Freon Condensers • Allied Refrigeration and Air Conditioning Equipment

INDUSTRIAL HYGIENE

(*Continued from page* 142)

Crass, Jr., secretary-treasurer of the Manufacturing Chemists' Association, Inc., discussed the steps that are being taken by the chemical industries to combat air pollution.

Specific aspects of industrial health were taken up at technical conferences which included panel discussions and informal sessions, with individuals from the floor directing questions to the speakers and contributing information gained through their own experiences.

• **ENGINEERING.**—The Engineering Conference brought to the attention of plant engineers new developments and ideas on engineering measures that may have effects on the working environment. Included were a discussion of developments in air and gas cleaning and papers on work in hot environments, noise, and handling of radioisotopes. A combined panel discussion-related engineering and legal aspects of control of industrial hazards.

The effects of heat and humidity on man at work were briefly summarized and a simple method for evaluating the physiological strain through heart rate and body temperature changes was presented in a paper by Lucien Brouha, M.D., Haskell Laboratory for Toxicology and Industrial Medicine, E. I. du Pont de Nemours & Company, Inc. From the point of view of the workers' health and efficiency it is essential in industry to develop means of reducing the physiological cost of working in heat. According to circumstances several methods can be used and their effectiveness can be evaluated in relation to the workers' physiological reactions. Examples were given of results obtained by improving the ventilation in the shop, improving the water supply and intake, organizing adequate rest periods, utilizing air-conditioned rest rooms which enable the workers to recover fully and rapidly after exposure to heat. For specific jobs that have to be performed under very severe conditions a ventilated suit has been developed at Haskell Laboratory. Experimental tests and results obtained in industry with that suit were presented. The general conclusion was that by applying various methods that have already been tested in the laboratory as well as in industrial jobs the stress of physical work in heat can be reduced considerably.

METHANE SYNTHESIS

passes laboratory tests by gas technologists, may be booster for natural gas systems.

Hope for the many families that would like their homes heated with gas—but are now thwarted because their local utilities cannot secure enough natural gas—has resulted from research performed at the Institute of Gas Technology, affiliated with Illinois Institute of Technology, Chicago.

The biggest problem involved in achieving a natural gas substitute—the manufacture of a gas composed primarily of methane—has been solved on a laboratory basis, it was reported at the Gas Institute's 14th annual meeting, held in Chicago.

• **WAIT.**—The development may help bring an end to the waiting lists for gas heat that exist in most large U. S. cities, according to Gas Institute sources. But the public was warned the process—the pressure hydrogasification method—must be subjected to tests at the pilot plant level before it can be considered for commercial use.

The aim of the Institute in developing a natural gas substitute is to produce a gas with the same heating value, specific gravity, and combustion characteristics as the natural gas whose supply it augments.

• **PROCESS.**—The most significant problem in producing a substitute lies in the fact that the materials gasified, such as coal, oil, and natural gas liquids, do not alone contain enough hydrogen to produce as much methane as desired.

To solve the problem, the Institute has been investigating a number of processes, including the pressure hydrogasification method.

In this process, hydrogen is added to coal or oil during gasification. The next step involves inducing the hydrogen and carbon from the oil or coal to combine into methane, which is accomplished through the use of controlled temperature and pressure and suitable catalysts.

The next move in the development of the pressure hydrogasification process is to complete tests at the pilot plant level.

WEATHER

has completed record 7-year cycle of warm winters, and at mid-November was again 9% above normal.

The weather propehts are having their usual seasonal fiesta predicting what this winter holds in store for the fuel industries and the consuming public. Bases for the forecasts cover a wide range of possible signs, including woolly bears, thickness of tree bark, length of cotton fibers, sun spots, herring runs, bird migrations, A-bomb experiments and animal activities.

One sensible seer commented that if the squirrels were observed to be unusually active in gathering nuts, all it meant was that there had been a good crop of nuts.

• **RECORD.**—Whatever the weather may be this winter, it is a fact that northeastern sections of the country have experienced seven warmer than normal winters in succession. That has been the longest series of either warmer or colder than normal seasons in the 84 years the New York City Weather Bureau has been keeping records. There were six colder than normal winters in 1871-1877 and another six in 1882-1888, and there were six warmer than normal ones in 1927-1933, but never seven of either in a row until last year, even though it was the closest to normal since 1947-1948. If this season is also a warm one, it will be eighth in succession.

• **TOO EARLY TO TELL.**—Nor do the opening months seem to have a bearing on the remainder of the season. The winter of 1947-1948 was unusually mild through mid-November, but turned out to be the last colder than normal one we have had. Conversely, it was colder than normal through mid-November in 1952, but the season wound up as one of the warmest on record.

We can only wait and see what happens, as the heating season, although 9% warmer than normal at mid-November, was only 13%.

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- COMPLETE—NO WOOD MOLDINGS TO ADD!

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First Grille ever designed specifically for thin doors and partitions. Anyone can install it in just a few minutes time. No close tolerances required . . . almost a half-inch extra on sides for positioning. Telescoping auxiliary frame fastens to grille with posts and screws. Clamps tight. No holes to position. Practically no danger of ruining door. No wood moldings. All steel. Rattle-proof. No vision, with 80% free area. Available with or without frame, all sizes. Gray or tan prime coated, or Hammertone finish in grey or bronze.

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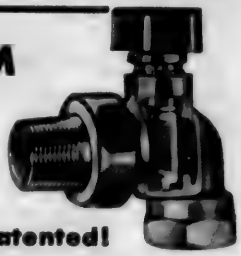

. . . so different they're patented!

CIRCULATOR VALVES (pat. pending) have a larger waterway than any other hot water valve, assures full, unrestricted flow. New T-type handle opens —closes in ¼ turn. Straightway—angle patterns —thread or sweat connections—for 60 p.s.i.

BALANCING FITTINGS have a unique sloping seat that modulates flow *far more accurately*—from full open to any degree of closure—than the usual vertical seat. Thread or sweat connections. Line also includes vent tees, union elbows and connectors.

Write for new Hot Water Bulletin for your use and new consumer booklet ACHV-12. It's designed to help you sell consumers on the advantages of hot water baseboard heating.

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YOU USE LESS POWER...
SAVE CONDENSER WATER...
SAVE UPKEEP COST

For large refrigeration systems, NIAGARA gives you a choice between a battery of condensers (that may be cut on or off with the load) or a high capacity condenser that saves space.

Both have the patented "Duo-Pass" and "Oilout" that remove superheat and keep the system free of oil. Results: you save one-third or more of power cost and upkeep expense. Niagara Patented Balanced Wet Bulb Control gives lowest head pressure operation automatically. *Write for Bulletin 111.*

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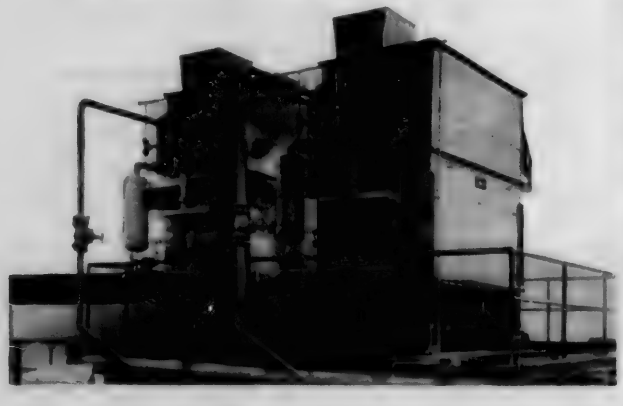

SCHOOL HEATING SYSTEMS

(*Concluded from page* 132)

59F line and follow it down to the evaporation temperature of 32F at point O. Strike up the isobar to the compressor inlet temperature, 50F at point O'. Read off the volume corresponding to this, which is 0.00184 M^3 per frig, or 3.275cfm per ton. The compressor is handling 32.75 cfm (assuming a volumetric efficiency of 1). The proposed new conditions are found on the line which begins at 50 deg., following it down to point O_1 at 14 deg. and striking up the isobar to a temperature of 41 deg which brings us to point $O^{1\prime}$ with a corresponding volume of 0.00265 M^3 per frig or 4.715 cfm per ton. Under the new conditions the compressor at the same efficiency as before will be capable of an output of $\frac{32.75}{4.715}$ tons of refrigeration or not quite 7 instead of 10.

Eight large scale graphs for ammonia (NH_3), Freon 12 (CF_2Cl_2), Freon 22 (CHF_2Cl) and methyl chloride (CH_3Cl), have been prepared covering the useful ranges of these refrigerants (high and low temperature ranges for each) and have been published with the author's paper in La Termotecnica (Milan) Vol. **9**, No. *9*, p. 452.

Dual Purpose Heat Pump

A diagram of this type would be very helpful in working out the prospects for the domestic heat pump which is supposed to provide hot water and a cool larder. The chief engineer of the South Western Electricity Board in Britain, G. O. McLean, has published an article on this subject in the Journal of the Institute of Fuel (**27**, *172*, 224). The idea, of course, is not new. It was proposed some time ago in a paper to the Royal Philosophic Society of Glasgow by William Thomson, later Lord Kelvin. The date was 1852.

Calculations showed that a compressor of ⅓ hp available on the British market, which was found by experiment to use 250 to 300 watts, should give sufficient hot water for the average family. One very common size of hot water tank over here is 18 inches dia. and 36 inches high, holding 36 U. S. gallons. The whole compressor unit has been immersed in such a tank, with the evaporator only outside the tank and surrounded by shelves to store foodstuffs. The complete unit, which has been put on the market in this country, is about 2 ft square and 4 ft 6 in high. Apart from domestic applications, it is suggested such dual purpose machines might be used in dairies for chilling milk and providing hot water for washing bottles, for heating greenhouses by extracting the heat from compost heaps, space heating of dressing-rooms and the provision of hot showers by heat extracted from ice-rinks, and keeping beer cellars cool while providing washing-up water for glasses at the bar.

For the purely domestic application, it is not clear where it fits in. The housewife is used to a warmed linen cupboard and a refrigerator. This new gadget gives neither. It will, however, maintain a larder at 40 deg F and supply hot water at 150 deg F for an electrical consumption on average of around 1800 units a year. There may be a sale for it here, although it would be more attractive in a country where deep freezers are more common in the home, and the refrigerator less important.

DUST-magnet T.M.
filter is a superior product

says Albert J. Mattes
General Manager
J. M. Oberc, Inc., Detroit

Mr. Mattes, as general manager of one of Michigan's largest refrigeration and heating equipment jobbers and manufacturers' representatives, carefully analyzes a product and its market before deciding to handle it. Here is what he says about the Dust-magnet filter:
"I chose the Dust-magnet filter because it is truly permanent and easy to clean. It's a superior product, the price is sensible, and the company is reliable and cooperative."

The Dust-magnet electrostatic filter is made of patented woven white plastic installed under spring tension in a galvanite steel frame. Ask for literature.

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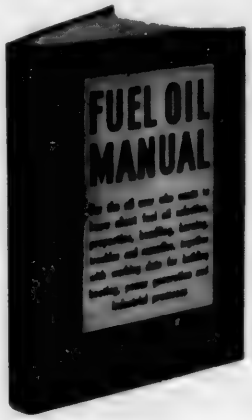

Here is a book that will give you a comprehensive picture of the characteristics and uses of every type and grade of fuel oil. The author explains the meaning of each oil property, and shows how this information is applied to the selection, handling and burning of fuel oil. Impurities and how they effect combustion are described fully, and a special chapter describes fuel oil additives and how they are used. Another chapter lists troubles which may be encountered in using fuel oils, and shows the correct remedy to apply in each case. Technical language is avoided wherever possible, and all terms are fully explained.

160 Pages **$3.50** 34 Tables

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A thorough engineering research preceded the manufacture of Airtherm Cabinet Unit Heaters. Alternative features and designs were analyzed from the standpoint of proved practicality and efficiency.

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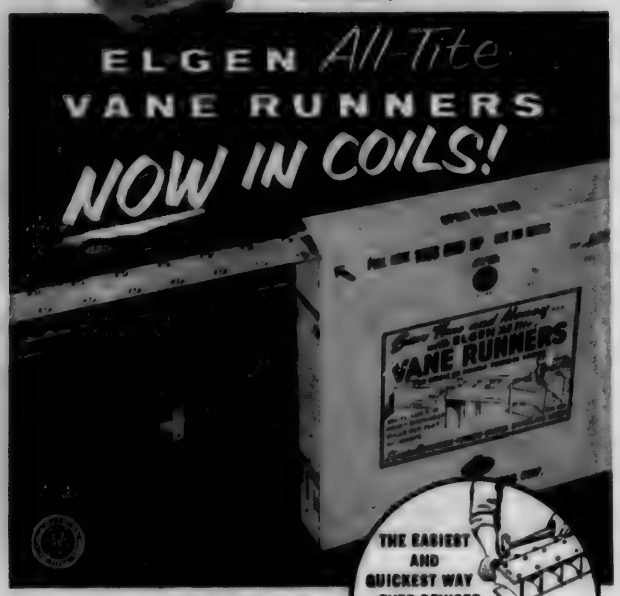

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New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in *your cost per job.*

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
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STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF "AIR CONDITIONING, HEATING AND VENTILATING" published monthly at Norwalk, Connecticut, for October 1st., 1955.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, The Industrial Press, 93 Worth Street, New York 13, N. Y.
Editor, Clifford Strock, 93 Worth Street, New York 13, N. Y.
Managing editor, None.

Business managers: Robert B. Luchars, Edgar A. Becker, Harold L. Gray, 93 Worth Street, New York 13, N. Y.

2. The owner is:

The Industrial Press, 93 Worth St., New York 13, N. Y.; Robert B. Luchars, 93 Worth St., New York 13, N. Y.; Edgar A. Becker, 93 Worth St., New York 13, N. Y.; Franklin D. Jones, 93 Worth St., New York 13, N. Y.; Walter E. Robinson, 93 Worth St., New York 13, N. Y.; Charles O. Herb, 93 Worth St., New York 13, N. Y.; Harold L. Gray, 93 Worth St., New York 13, N. Y.; Clifford Strock, 93 Worth St., New York 13, N. Y.; Suno E. Larson, 93 Worth St., New York 13, N. Y.; Helena E. Oberg, 65-82nd St., Brooklyn 9, N. Y.; Edgar L. Becker, Nominee for Nancy Jane Becker, Susan Louise Becker and Donald Louis Becker, 370 Bedford Rd., Ridgewood, N. J.; First National Bank of Montclair and R. B. Luchars, Trustees (Beneficiaries Unknown), Upper Montclair, N. J.; First National Bank of Montclair and Leigh Roy Urban, Trustees (Beneficiaries Unknown), Upper Montclair, N. J.; First National Bank of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries Unknown), Upper Montclair, N. J.; David D. Ketchum, 13 N. Main St., Cohasset, Mass.; Lee W. Noyes, Guardian for Susan Yarnall Urban, Greensboro, Vt.; Lee W. Noyes, Trustee U/W of Robert L. Urban, Greensboro, Vt.; John T. Urban, 8 Craigie Circle, Cambridge, Mass.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are:

Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Franklin D. Jones, 93 Worth St., New York 13, N. Y.; Robert B. Luchars, 93 Worth St., New York 13, N. Y.; Ann Pelletier, 140 Cabrini Blvd., New York 33, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King Street, Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 29th day of September, 1955.

ALEXANDER LOYKA

Notary Public, State of New York, No. 41-7611350. Qualified in Queens County. Commission expires March 30, 1956.

Canadian Degree Days for October, 1955*

City	October		Cumulative	
	1955	Normal	1955	Normal
Calgary, Alta.	733	722	1235	1154
Charlottetown, P. E. I.	563	539	838	761
Crescent Valley, B. C.	703	698	1094	1058
Edmonton, Alta.	749	749	1221	1191
Fort William, Ont.	673	722	1033	1076
Grande Prairie, Alta.	873	812	1396	1292
Halifax, N. C.	467	499	662	688
London, Ont.	427	508	599	634
Medicine Hat, Alta.	573	601	954	868
Moncton, N. B.	599	595	910	877
Montreal, P. Q.	491	561	691	741
North Bay, Ont.	587	694	920	958
Ottawa, Ont.	505	595	734	799
Penticton, B. C.	549	527	788	740
Prince George, B. C.	816	741	1318	1185
Quebec City, P. Q.	598	651	927	927
Regina, Sask.	735	794	1171	1202
St. John, N. B.	549	558	875	828
Saskatoon, Sask.	738	781	1191	1177
Timmins, Ont.**	678	781	1115	1186
Toronto, Ont.	362	504	498	672
Vancouver, B. C.	477	459	724	693
Victoria, B. C.	499	446	797	710
Windsor, Ont.	359	425	446	479
Winnipeg, Man.	640	744	984	1074

*These data are supplied through the courtesy of the Meteorological Division Air Service Branch, Department of Transport, Canada.

**The Department reports the closing of the weather station at Porquis Junction, Ont., starting with Sept., 1955. They have substituted data for Timmins, Ont., and will continue to report for that station in the future.

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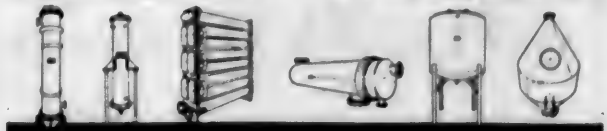

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

ATOMIC EXPOSITION—1955 Atomic Exposition, sponsored by American Institute of Chemical Engineers, at Municipal Auditorium and Annexes, Cleveland, Ohio. A. F. Denham, director of Atomic Exposition Management, 931 Book Building, Detroit 26, Mich. . . . . **DECEMBER 10-16, 1955.**

NUCLEAR CONGRESS—Nuclear Congress and Atomic Exposition, sponsored by the Engineers Joint Council, to be held at Municipal Auditorium, Cleveland, Ohio. Stewart E. Reimel, secretary of the Council, 29 W. 39th St., New York 18, N. Y. . . . . **DECEMBER 12-17, 1955.**

ASHAE MEETING—Annual meeting of the American Society of Heating and Air Conditioning Engineers, Inc., at the Sheraton-Gibson Hotel, Cincinnati, Ohio. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JANUARY 23-25, 1956.**

VENTILATION CONFERENCE—5th annual Industrial Ventilation Conference, sponsored jointly by the Michigan Department of Health, and the School of Engineering, Michigan State University, to be held at the Kellogg Center, Michigan State University, Lansing, Mich. J. C. Barrett, ventilation engineer, Division of Occupational Health, Michigan Department of Health, Old Dewitt Road, Lansing 4, Mich. . . . . **FEBRUARY 6-9, 1956.**

CORROSION SHOW—1956 Corrosion show, held in conjunction with the 12th annual conference of the National Association of Corrosion Engineers, at the Hotel Statler, New York, N. Y. A. B. Campbell, executive secretary of the Association, 1061 M & M Building, Houston 2, Tex. . . . . **MARCH 12-16, 1956.**

GAMA MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at The Greenbrier, White Sulphur Springs, West Virginia. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. . . . . **APRIL 19-21, 1956.**

MECHANICAL CONTRACTORS MEETING—Annual meeting of The Mechanical Contractors Association of America (formerly, Heating, Piping and Air Conditioning Contractors National Association), at The Kentucky Hotel, Louisville, Ky. Secretary of the Association, 1250 Avenue of the Americas, New York 20, N. Y. . . . . **MAY 15-18, 1956.**

ASRE MEETING—52nd annual meeting of the American Society of Refrigerating Engineers, at the Sheraton-Gibson Hotel, Cincinnati, Ohio. R. C. Cross, secretary of the Society, 234 5th Ave., New York 1, N. Y. . . . . **JUNE 3-6, 1956.**

PLUMBING AND HEATING EXPOSITION—1956 National Plumbing and Heating Exposition, in conjunction with the 74th meeting of the National Association of Plumbing Contractors, Inc., to be held in the Milwaukee Auditorium, Milwaukee, Wis. Secretary of the Association, 1016 20th, N. W., Washington, D. C. . . . . **JUNE 11-14, 1956.**

OIL-HEAT SHOW—21st National Oil-Heat Show, to be held concurrently with the 34th Annual OHI convention, of the Oil-Heat Institute of America, at the new Coliseum, New York, N. Y. R. H. L. Becker, managing director of the Institute, 500 Fifth Ave., New York 36, N. Y. . . . . **JUNE 11-15, 1956.**

ASME MEETING—Semi-annual meeting of The American Society of Mechanical Engineers, at the Hotel Statler, Cleveland, Ohio. Secretary of the Society, 29 W. 39th St., New York, N. Y. . . . . **JUNE 17-21, 1956.**

TESTING MATERIALS MEETING—59th annual meeting of the American Society for Testing Materials, at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. . . . . **JUNE 17-22, 1956.**

ASHAE MEETING—Semi-annual meeting of the American Society of Heating and Air-Conditioning Engineers, Inc., at the Shoreham Hotel, Washington, D. C. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JUNE 18-20, 1956.**

INSTRUMENT SOCIETY EXHIBIT—11th annual Instrument-Automation Conference and Exhibit (International), of the Instrument Society of America, at the new Coliseum building, New York, N. Y. J. McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 13, Pa. . . . . **SEPTEMBER 17-21, 1956.**

HEATING AND AIR CONDITIONING EXPOSITION—1957 International Heating & Air-Conditioning Exposition, under the auspices of the American Society of Heating and Air-Conditioning Engineers, Inc., to be held at International Amphitheater, Chicago, Ill. E. K. Stevens, manager, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. . . . . **FEBRUARY 25-MARCH 1, 1957.**

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NEW CATALOGS

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FLUID COOLER BULLETIN — Literature on a line of fluid coolers is announced by The Trane Co., La Crosse, Wis. The 8-page bulletin (S-395) contains information on the construction, performance, and maintenance of the units, as well as data on each of their component parts. .....**Item 58**

PLASTIC VALVE DEMONSTRATOR—A cutaway plastic demonstrator of a seatless blow-off valve and a catalog (B-426) are available from Yarnall-Waring Co., Philadelphia, Pa. The plastic demonstration model works in the same fashion as the actual valve it represents. .....**Item 59**

COOLING EQUIPMENT BULLETINS—Five bulletins giving the specifications of forced and induced draft cooling towers, air handling units, and condensers are issued by Deansteel Products, San Antonio, Tex. .....**Item 60**

FOLDER ON BOILER CORROSION — Eleven Ways To Avoid Boiler Tube Corrosion is the title of a publication (Bulletin TR-537) by Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa. The 8-page folder explains many of the causes of corrosion in boiler tubes along with suggested methods of eliminating these same causes. .....**Item 61**

HEATING SYSTEMS MANUAL — A 28-page application manual, No. 2685, for high temperature and pressure hot water heating systems is published by C. A. Dunham Co., Chicago, Ill. The manual contains a discussion of the systems including design, installation and maintenance data. Drawings, charts, graphs and tables are used to amplify the text. .....**Item 62**

UNIT CONDITIONER CATALOG—Bulletin No. 8227, describing Diaflow unit conditioners for summer cooling and winter heating in multi-room structures, is available from American Blower Corp., Detroit, Mich. The catalog contains installation drawings, listing detailed dimensions for the five sizes available. .....**Item 63**

CENTRIFUGAL PUMP IS DESCRIBED—A flier describing the Centri-Chem Type 20 stainless steel, centrifugal pump, for handling corrosives, is available from Eco Engineering Co., Newark, N. J. Information includes mechanical features, performance data, and component materials of construction. .....**Item 64**

MAGNETIC STARTER BULLETIN — An eight-page publication describing a line of magnetic starters for air conditioning and refrigeration equipment is available from General Electric Co., Schenectady, N. Y. Designated GEA-6301, the illustrated bulletin describes features, ratings, and dimensions of the starters. It also contains wiring diagrams, catalog numbers, and installation requirements. .....**Item 65**

PROPORTIONING PUMP BULLETIN — A color bulletin (1105-2) describing the Model 1105 Adjust-O-Feeder proportioning pump is issued by Proportioneers, Inc., Division of B-I-F Industries, Inc., Providence, R. I. The bulletin contains a capacity table, typical applications with schematic diagrams, and lists the pump's main advantages. .....**Item 66**

OIL BURNER COLOR FOLDER—A folder (No. N-1132) featuring a line of seven oil burners, with firing ranges from 0.65 to 20 gph, is available from The Nu-Way Corp., Rock Island, Ill. Descriptions and specifications are presented in four-color block arrangement. .....**Item 67**

WATER HEATER LITERATURE—A self-mailer (Form 981) for plumbing contractors to acquaint their customers with the restaurant uses of the two-temperature Sanimaster automatic gas water heater is available from Ruud Mfg. Co., Kalamazoo, Mich. The two-color literature, with four pages, includes charts for sizing the water heaters to conveyor, door, and hood type dishwashers. .....**Item 68**

FLUE GAS ANALYZERS—Portable flue gas analyzers are described in a brochure issued by Thermco Laboratories, Michigan City, Ind. The specifications and applications of five different models are given in the folder. .....**Item 69**

PIPING MANUAL—A manual containing data required for piping flexibility analysis has been prepared by the research staff of Tube Turns, Louisville, Ky. Designated File 4.03, the 27-page manual also contains tables and charts in one section and code rules in a third section. .....**Item 70**

CIRCULAR ON BOOSTER PUMPS — A product circular (Bulletin HC-855) released by Bell & Gossett Co., Morton Grove, Ill., features the company's line of universal pumps. The circular shows how a universal pump can be used for boosting city water pressures in buildings. .....**Item 71**

DRIVE SELECTION BOOKLET—A 74-page booklet, Tex-Book 20P40, carrying multi-color tables for the selection of constant speed Texrope V-belt drives is released by Allis-Chalmers Mfg. Co., Milwaukee, Wis. In addition to providing selection tables for A, B, C, D and E section belts, the handbook features information on design features, basic drive principles, and technical data on sheaves as well as helpful hints for economical and dependable operation of V-belt drives. .....**Item 72**

PIPING JOINT CATALOG — A 20-page catalog (No. 215-B) on flexible ball joints for use in piping is published by Barco Mfg. Co., Barrington, Ill. The catalog contains engineering specifications and data, installation advice, and maintenance or repair instructions. .....**Item 73**

FOLDER ON PORTABLE HEATER—A lightweight portable heater is the subject of a 4-page folder published by Master Vibrator Co., Dayton, Ohio. A cutaway drawing shows the vital parts of the heater, and operational photos illustrate how a plasterer, bricklayer, carpenter, plumber, or cement contractor can use the small heater on scaffolds, in basements or wherever one is working. .....**Item 74**

(*Continued on page* 158)

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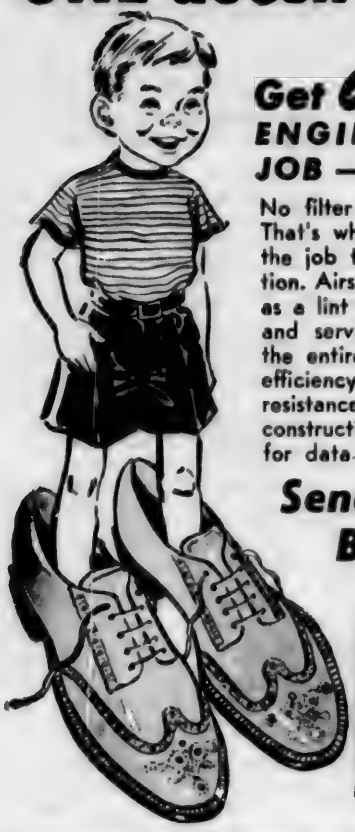

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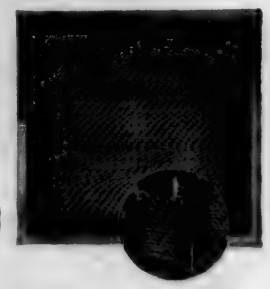

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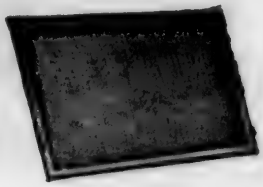

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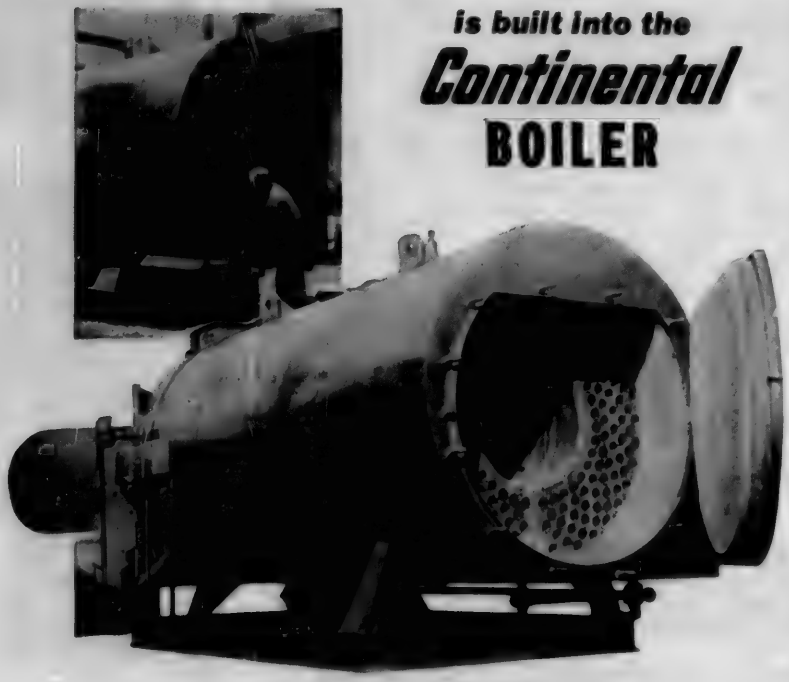

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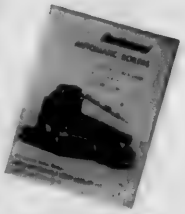

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NEW CATALOGS

(*Continued from page* 156)

Use the prepaid postcard on page 143 for securing your copies of catalogs described in this department.

INDUSTRIAL WATER HEATING—A semi-technical bulletin, No. 923, published by the Fred H. Schaub Engineering Co., Chicago, Ill., is available to plant engineers interested in the problems of large-scale hot water heating, such as those encountered in commercial launderies. The bulletin explains the nature of the problems involved in big-swing hot water loads. .....**Item 75**

BULLETIN ON STEAM BOILERS—Installations of packaged steam boilers are photographically illustrated in Bulletin No. 516 published by Johnston Brothers, Inc., Ferrysburg, Mich. The back page of the bulletin contains illustrations and a description of the firing equipment used in the boilers. .....**Item 76**

WATER GENERATOR BULLETIN—Forced recirculation generators for high temperature water heat distribution systems are described in a 10-page bulletin, No. 700, released by The International Boiler Works Co., East Stroudsburg, Pa. The bulletin describes the specific features of the forced recirculation generators, called International-LaMont, and cites some of the advantages of high temperature water systems. .....**Item 77**

HEATING PARTS CATALOG—A 240-page catalog of parts used in the service and installation of light and heavy oil burners, gas burners and stokers is being distributed by Sid Harvey, Inc., Valley Stream, N. Y. The illustrated catalog gives the specifications and new and rebuilt trade prices of the parts listed. The catalog is available to recognized installers and service men. .....**Item 78**

FOLDER ON AIR CONDITIONING—Air conditioning's contribution to garment manufacturing is described in a folder prepared by Carrier Corp., Syracuse, N. Y. The illustrated and informative pamphlet discusses important features provided by air conditioning. .....**Item 79**

VIBRATION MOUNTINGS CATALOG—Vibration mountings for medium and heavy weight machinery are described in catalog FP-55 issued by T. R. Finn & Co., Inc., Industrial Div., Hawthorne, N. Y. Load capacities and frequencies, typical installations, and the company's engineering services are described. .....**Item 80**

RADIANT HEATING REPORT—Radiant heating and snow melting for airport installations is the subject of a 32-page report prepared by Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa. Illustrating the report are twenty photographs. .....**Item 81**

CATALOG ON PLASTIC PUMPS—A catalog (No. 55) on Flex-i-liner plastic pumps is announced by Vanton Pump and Equipment Corp., Hillside, N. J. Illustrations and diagrams of both standard and XB Models are included, complete with operating and performance data. .....**Item 82**

WATER HEATER HOOKUPS—Descriptive diagrams showing hookups of indirect (tankless) water heaters for hot water usage are available from Portmar Boiler Co., Brooklyn, N. Y. The tankless hookup diagrams are intended for contractors, especially where storage tanks are not required. They show how delivery of continuous tankless volume hot water is possible 24 hours a day. ----------**Item 83**

WATER DE-CONTAMINATION — A four-page bulletin explaining a method of removing iron, gas, taste, and odors from water without the use of chemicals is issued by Aquatrol Ferr-X Corp., Clifton, N. J. The bulletin describes a single pumping closed pressure system. ----------**Item 84**

RADIANT HEATER BULLETIN—A 4-page bulletin (No. 950) illustrating in full color, an electric radiant wall panel is available from Edwin L. Wiegand Co., Pittsburgh, Pa. Various installations of the radiant panel heater are shown. ----------**Item 85**

BULLETIN ON FLOW METERS — An eight-page bulletin (OG 409) describing Rotocycle liquid flow meters is issued by Meter and Valve Div., Rockwell Mfg. Co., Pittsburgh, Pa. Also described is a line of accessories for the meters. ----------**Item 86**

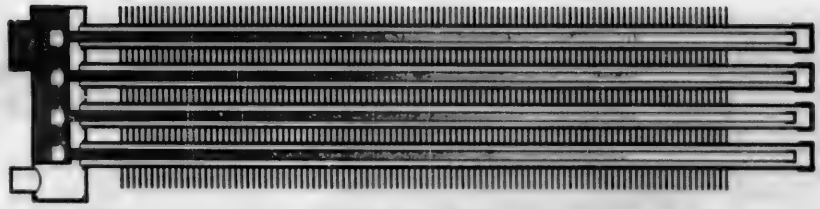
INDUSTRIAL FAN CATALOG—An illustrated four-page catalog (Bulletin No. 6514) describing the Model K Ventura fans for industrial heavy-duty exhaust applications is available from American Blower Corp., Detroit, Mich. Performance data such as delivery ratings at various static pressures, fan speed, motor horsepower, quietness rating, and maximum net weight are given for each of the forty-five different direct-drive fan units available in the line. ----------**Item 87**

HEAT TRANSFER EQUIPMENT—Catalog No. 255 lists and describes the variety of heat transfer equipment manufactured by Young Radiator Co., Racine, Wis. The equipment includes air conditioning units, heating and cooling coils, unit heaters, baseboard convectors for hot water systems, and convectors for use with steam or hot water systems. ----------**Item 88**

CATALOG OF HOSE COUPLINGS—A revised, 20-page catalog of Quick-Seal hose couplings is released by Titeflex, Inc., Springfield, Mass. To facilitate ordering, tables and diagrams are included in the catalog which indicate available coupling sizes and types of hose connection, and provide instructions for selecting the right type and size coupling for a particular application. ----------**Item 89**

HOW TO USE GAGES—Technical information, charted data and diagrams on the purpose and use of specialized instruments and gages comprise a new 72-page catalog published by F. W. Dwyer Mfg. Co., Michigan City, Ind. The catalog is, in effect, a textbook on the efficient measurement of combustion, draft, pressure, flow, vacuum, carbon dioxide, smoke, velocity, static pressure, pressure differential, temperature, and other factors which may be encountered in the heating, ventilating and refrigerating field. ----------**Item 90**

Use the prepaid postcard on page 143 for securing your copies of catalogs described in this department.



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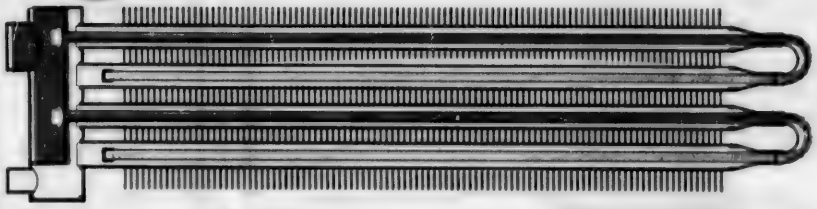

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135HW Sizes ½", ¾", 1" Feed Water Pressure Regulators

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N39 Size ½"

Dual Controls

Feeds water to boiler at 12 lbs. — Pressure relief at 30 lbs.

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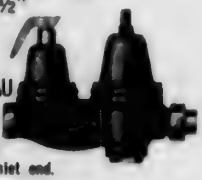
N450 Popular design Size ½"

N450C

Nos. N450C or 45AC have check valve and strainer



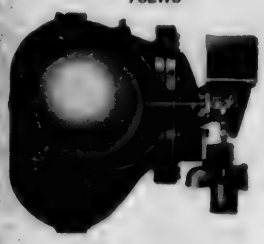
45AU

Nos. 45AU or N450U have sweat copper union applied to inlet end.

BOILER WATER LEVEL CONTROLS FOR LOW PRESSURE STEAM HEATING BOILERS

Boiler Water Feeders

60LWD



76LWD

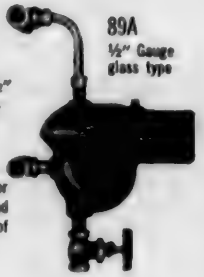
Feeder cut-off combinations

Low Water Cut-Offs

Maximum steam pressure 25 lbs.

101A Exclusive 2½" screw-in type with sediment chamber.

193A 2½" Screw-in type for use where shallow section and depth of jacket prevent use of No. 93A.



89A ½" Gauge glass type

93A 2½" screw-in type

50A 1" Float chamber connections for use on process boilers and hot water heating boilers. Max. steam press. 50 lbs.

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60	½" gauge glass	up to 5,000 sq. ft. rad.	25 lbs.	150 lbs.
76	1" chamber, ¾" feed valve	over 5,000 sq. ft. rad.	35 lbs.	150 lbs.
81	1" chamber, ¾" feed valve	over 5,000 sq. ft. rad.	35 to 75 lbs.	150 lbs.

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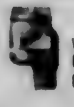

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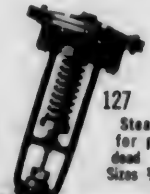
152 Steam Regulator for process. Sizes ½", ¾", 1".



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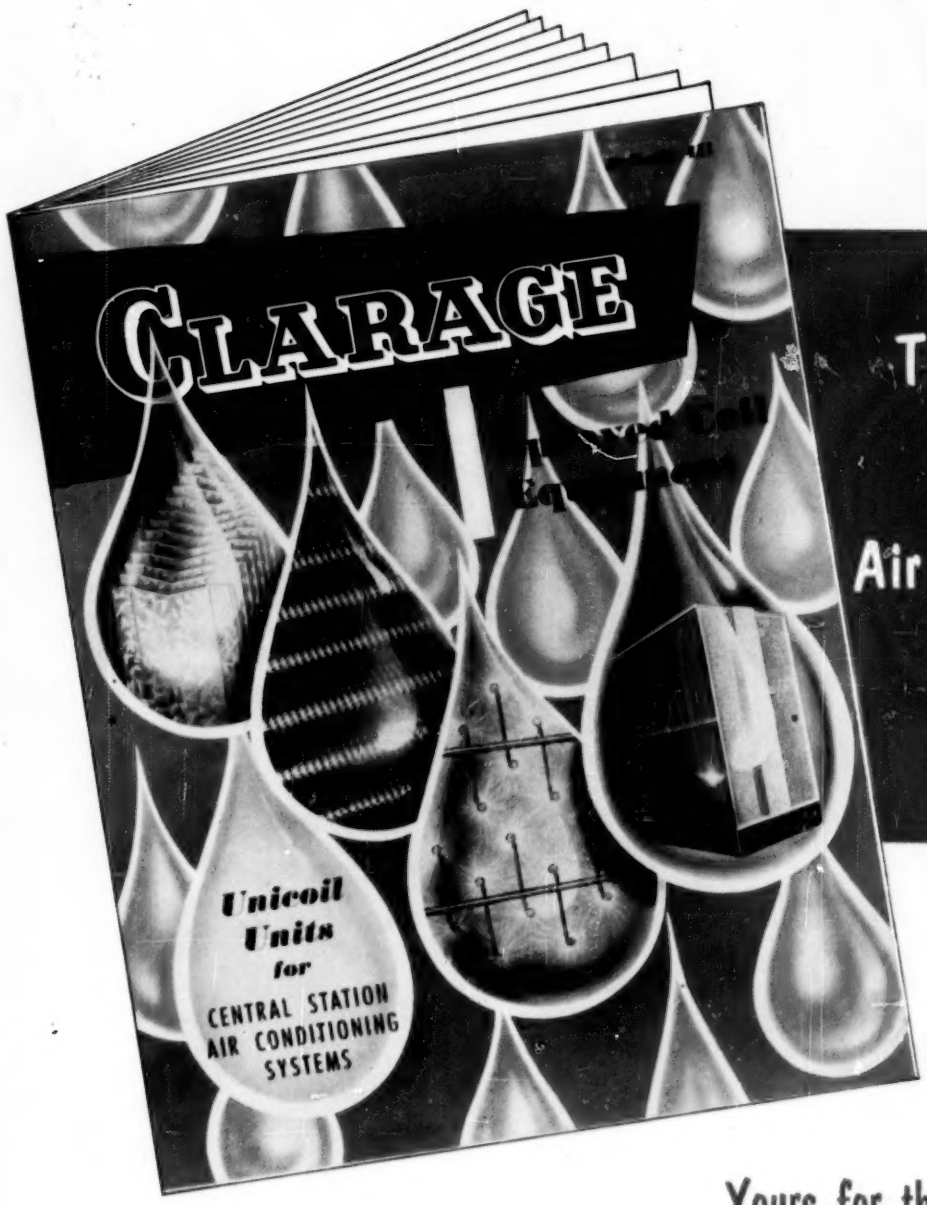
A	B	C	D	E	F	Nominal Pipe Diameter, Inches				
Temp. Diff., Deg.	Sat. Steam Temp. (Col. A +70 Deg.)	Abs. Steam Press. for Col. B Temp.	Latent Heat, Btu per Lb.	Heat Loss, Btu per Sq. Ft. per Hr.	Heat Loss, Lb. per Sq. Ft. per Hr.	7	8	9	10	12
						Outside Surface Area, Sq. Ft., per 100 Lineal Feet				
						199.62	225.80	251.98	281.43	333.80
						Pounds of Steam Lost per Hour per 100 Lineal Feet				
265	335	110	882.7	809.86	0.9175	183.15	207.17	231.19	258.21	306.26
270	340	118	878.5	833.88	0.9492	189.48	214.33	239.18	267.13	316.84
275	345	126	874.4	857.90	0.9811	195.85	221.53	247.22	276.11	327.49
280	350	135	870.2	881.92	1.0135	202.31	228.85	255.38	285.23	338.31
285	355	144	865.8	905.94	1.0464	208.88	236.28	263.67	294.49	349.29
290	360	153	861.7	929.96	1.0792	215.43	243.68	271.94	303.72	360.24
295	365	163	857.4	953.98	1.1126	222.10	251.23	280.35	313.12	371.39
300	370	173	853.0	978.00	1.1465	228.86	258.88	288.90	322.66	382.70
305	375	184	848.6	1007.14	1.1868	236.91	267.98	299.05	334.00	396.15
310	380	196	844.1	1036.28	1.2277	245.07	277.21	309.36	345.51	409.81
315	385	208	839.5	1065.42	1.2691	253.34	286.56	319.79	357.16	423.63
320	390	220	834.9	1094.56	1.3110	261.70	296.02	330.35	368.95	437.61
325	395	233	830.3	1123.70	1.3534	270.17	305.60	341.03	380.89	451.76
330	400	248	825.5	1152.84	1.3965	278.77	315.33	351.89	393.02	466.15
335	405	262	820.6	1181.98	1.4404	287.53	325.24	362.95	405.37	480.81
340	410	277	815.8	1211.12	1.4846	296.36	335.22	374.09	417.81	495.56
345	415	292	810.8	1240.26	1.5297	305.36	345.41	385.45	430.50	510.61
350	420	309	805.8	1269.40	1.5753	314.46	355.70	396.94	443.34	525.84
355	425	326	800.7	1303.86	1.6284	325.06	367.69	410.32	458.28	543.56
360	430	344	795.5	1338.32	1.6824	335.84	379.89	423.93	473.48	561.59
365	435	362	790.2	1372.78	1.7373	346.80	392.28	437.76	488.93	579.91
370	440	382	784.9	1407.24	1.7929	357.90	404.84	451.77	504.58	598.47
375	445	402	779.4	1441.70	1.8498	369.26	417.68	466.11	520.59	617.46
380	450	423	773.8	1476.16	1.9077	380.82	430.76	480.70	536.88	636.79
385	455	444	768.1	1510.62	1.9667	392.59	444.08	495.57	553.49	656.48
390	460	467	762.3	1545.08	2.0269	404.61	457.67	510.74	570.43	676.58
395	465	490	756.4	1579.54	2.0882	416.85	471.52	526.18	587.68	697.04
400	470	515	750.3	1614.00	2.1511	429.40	485.72	542.03	605.38	718.04
405	475	540	744.1	1657.66	2.2277	444.69	503.01	561.34	626.94	743.61
410	480	566	737.8	1701.32	2.3059	460.30	520.67	581.04	648.95	769.71
415	485	593	731.3	1744.98	2.3861	476.31	538.78	601.25	671.52	796.48
420	490	622	724.7	1788.64	2.4681	492.68	557.30	621.91	694.60	823.85
425	495	651	718.0	1832.30	2.5519	509.41	576.22	643.03	718.18	851.82
430	500	681	711.1	1875.96	2.6381	526.62	595.68	664.75	742.44	880.60
435	505	712	704.1	1919.62	2.7263	544.22	615.60	686.97	767.26	910.04
440	510	745	696.9	1963.28	2.8172	562.37	636.12	709.88	792.84	940.38
445	515	778	689.6	2006.94	2.9103	580.95	657.15	733.34	818.05	971.46
450	520	813	682.1	2050.60	3.0063	600.12	678.82	757.53	845.04	1003.5
455	525	848	674.6	2104.54	3.1197	622.75	704.43	786.10	877.98	1041.4
460	530	885	666.8	2158.48	3.2371	646.19	730.94	815.68	911.02	1080.5
465	535	923	659.0	2212.42	3.3572	670.16	758.06	845.95	944.82	1120.6
470	540	963	651.0	2266.36	3.4814	694.96	786.10	877.24	979.77	1162.1
475	545	1003	642.8	2320.30	3.6097	720.57	815.07	909.57	1015.9	1204.9
480	550	1045	634.5	2374.24	3.7419	746.96	844.92	942.88	1053.1	1249.0
485	555	1089	626.1	2428.18	3.8783	774.19	875.72	977.25	1091.5	1294.6
490	560	1133	617.5	2482.12	4.0196	802.39	907.63	1012.9	1131.2	1341.7
495	565	1180	608.7	2536.06	4.1664	831.70	940.77	1049.8	1172.5	1390.7
500	570	1228	599.7	2590.00	4.3188	862.12	975.19	1088.3	1215.4	1441.6

STEAM LOSSES FROM STEEL PIPING — 14 TO 24 INCH PIPE

A	B	C	D	E	F	Nominal Pipe Diameter, Inches				
Temp. Diff., Deg.	Sat. Steam Temp. (Col. A +70 Deg.)	Abs. Steam Press. for Col. B Temp.	Latent Heat, Btu per Lb.	Heat Loss, Btu per Sq. Ft. per Hr.	Heat Loss, Lb. per Sq. Ft. per Hr.	14	16	18	20	24
						Outside Surface Area, Sq. Ft., per 100 Lineal Feet				
						366.52	418.88	471.24	523.60	628.32
						Pounds of Steam Lost per Hour per 100 Lineal Feet				
50	120	1.692	1025.1	97.50	0.0951	34.86	39.84	44.81	49.79	59.75
55	125	1.941	1022.2	109.27	0.1069	39.18	44.78	50.38	55.97	67.17
60	130	2.221	1019.4	121.04	0.1187	43.51	49.72	55.94	62.15	74.58
65	135	2.536	1016.5	132.81	0.1307	47.90	54.75	61.59	68.43	82.12
70	140	2.887	1013.6	144.58	0.1426	52.27	59.73	67.20	74.67	89.60
75	145	3.280	1010.6	156.35	0.1547	56.70	64.80	72.90	81.00	97.20
80	150	3.716	1007.7	168.12	0.1668	61.14	69.87	78.60	87.34	104.80
85	155	4.201	1004.7	179.89	0.1790	65.61	74.98	84.35	93.72	112.47
90	160	4.739	1001.8	191.66	0.1913	70.12	80.13	90.14	100.16	120.20
95	165	5.334	998.8	203.43	0.2037	74.66	85.33	95.99	106.66	127.99
100	170	5.990	995.8	215.20	0.2161	79.20	90.52	101.83	113.15	135.78
105	175	6.716	992.8	226.68	0.2313	84.78	96.89	109.00	121.11	145.33
110	180	7.510	989.8	244.16	0.2467	90.42	103.34	116.25	129.17	155.01
115	185	8.382	986.8	258.64	0.2621	96.06	109.79	123.51	137.24	164.68
120	190	9.336	983.8	273.12	0.2776	101.75	116.28	130.82	145.35	174.42
125	195	10.385	980.8	287.60	0.2932	107.46	122.82	138.17	153.52	184.22
130	200	11.525	977.7	302.08	0.3090	113.25	129.43	145.61	161.79	194.15
135	205	12.772	974.6	316.56	0.3248	119.05	136.05	153.06	170.07	204.08
140	210	14.123	971.5	331.04	0.3408	124.91	142.75	160.60	178.44	214.13
145	215	16	968.3	345.52	0.3568	130.77	149.46	168.14	186.82	224.18
150	220	17	965.1	360.00	0.3730	136.71	156.24	175.77	195.30	234.36
155	225	19	961.7	377.30	0.3923	143.79	164.33	184.87	205.41	246.49
160	230	21	958.6	394.60	0.4116	150.86	172.41	193.96	215.51	258.62
165	235	23	955.0	411.90	0.4313	158.08	180.66	203.25	225.83	270.99
170	240	25	952.0	429.20	0.4508	165.23	188.83	212.43	236.04	283.25
175	245	27	949.0	446.50	0.4705	172.45	197.08	221.72	246.35	295.62
180	250	30	945.2	463.80	0.4907	179.85	205.54	231.24	256.93	308.32
185	255	33	941.2	481.10	0.5112	187.37	214.13	240.90	267.66	321.20
190	260	35	938.4	498.40	0.5311	194.66	222.47	250.28	278.08	333.70
195	265	39	934.4	515.70	0.5519	202.28	231.18	260.08	288.97	346.77
200	270	42	931.4	533.00	0.5723	209.76	239.73	269.69	299.66	359.59
205	275	45	928.2	553.48	0.5963	218.56	249.78	281.00	312.22	374.67
210	280	49	924.2	573.96	0.6210	227.61	260.12	292.64	325.16	390.19
215	285	53	920.9	594.44	0.6455	236.59	270.39	304.19	337.98	405.58
220	290	58	917.0	614.92	0.6706	245.79	280.90	316.01	351.13	421.35
225	295	62	913.4	635.40	0.6956	254.95	291.37	327.79	364.22	437.06
230	300	67	909.6	655.88	0.7211	264.30	302.05	339.81	377.57	453.08
235	305	72	906.0	676.36	0.7465	273.61	312.69	351.78	390.87	469.04
240	310	78	902.1	696.84	0.7725	283.14	323.58	364.03	404.48	485.38
245	315	84	898.3	717.32	0.7985	292.67	334.48	376.29	418.09	501.71
250	320	90	894.4	737.80	0.8249	302.34	345.53	388.73	431.92	518.30
255	325	96	890.6	761.82	0.8554	313.52	358.31	403.10	447.89	537.46
260	330	103	886.5	785.84	0.8865	324.92	371.34	417.75	464.17	557.01



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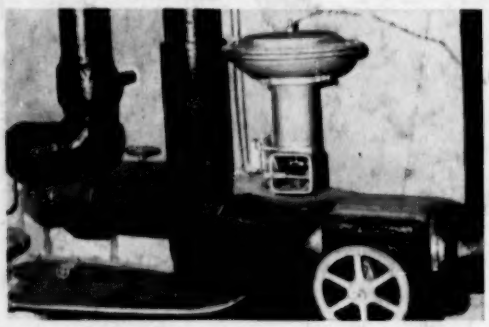
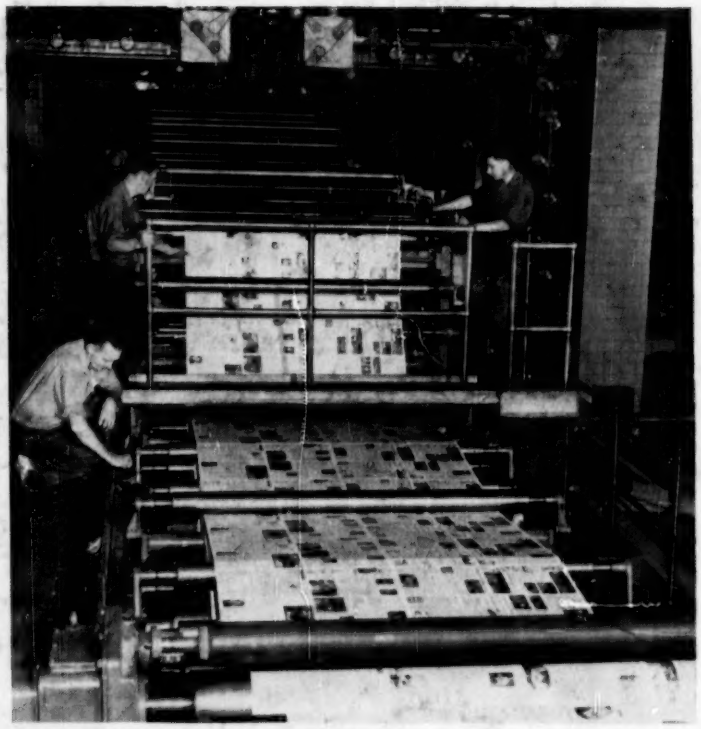


AIR CONDITIONING. A Johnson 3-Way Mixing Valve, with Pilot Positioner, gives precision control of chilled water supply to a unit serving a processing area.



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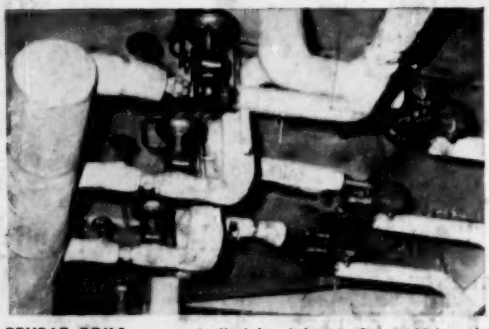

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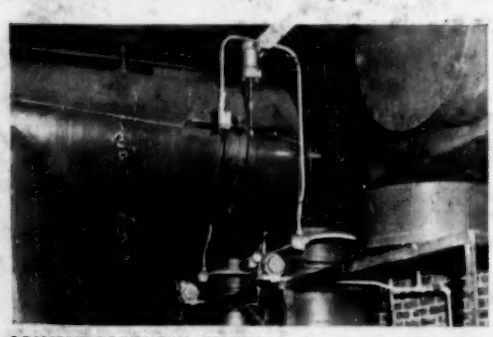

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